

**The Management of
Asbestos in the Non-
occupational Environment**
Guidelines for Public Health Units

Revised edition 2007

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Preface

The unique properties of asbestos have made it a valuable and, in some applications, an essential commercial material for which manufactured substitutes are still inadequate or very expensive.

Before the health risks were more completely appreciated, asbestos was regarded as a ‘miracle’ fibre of great versatility and usefulness.

Public concern regarding ambient levels of asbestos fibres in the air has arisen from an awareness that occupational airborne exposures to asbestos, especially in the extraction and manufacturing processes in the past, caused serious health problems, including asbestosis, lung cancer and mesothelioma.

In 1994 the Public Health Commission (PHC) released its policy advice to the Minister of Health on hazardous substances, which included the recommendation that ‘... the PHC, in consultation with the ... [other agencies] ... prepares recommendations on the control of asbestos outside the workplace for the purpose of avoiding or reducing unacceptable risks to health’ (PHC 1994). The Ministry of Health published a guideline on *The Management of Asbestos in the Non-Occupational Environment* in 1997 as a result of this recommendation. This guideline is under review to assess its currency and take account of recent scientific developments.

To protect the health of the public, the policy on the management of asbestos needs to be focused on the risks to individuals that asbestos may present and on sensible action that is related to the level of risk.

These guidelines are directed at non-workplace exposure to asbestos in air. The risk to health from workplace exposure is a matter for the Department of Labour.

These guidelines are intended to assist public health units of district health boards address public concerns and give sensible advice. In addition to drawing together background information, it suggests a protocol for a response related to the likely level of risk to health, and considers how risks may be evaluated and communicated.

The guidelines are also available on the Ministry of Health’s website at <http://www.moh.govt.nz>.

The Environmental Health Team, Ministry of Health, would like your comments on the implementation of the guidelines. They should be addressed to: Environmental Health Team, Ministry of Health, PO Box 5013, Wellington.

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In 2007 a general revision of the guidelines was undertaken to reflect a change in attitudes to asbestos, update references and include some changes to procedures.

Contents

| | |
|--|-----------|
| Introduction | 1 |
| Background | 1 |
| Purpose of the guidelines | 2 |
| Management of enquiries concerning asbestos | 2 |
| Risk analysis | 4 |
| Further information | 5 |
| | |
| Chapter 1: Risk Assessment Part 1: Hazard Identification | 7 |
| Main points | 7 |
| Asbestos | 8 |
| Asbestos fibre dimensions and type | 9 |
| Asbestos-containing materials | 10 |
| Non-occupational sources of the hazard | 14 |
| Release of asbestos fibres from asbestos-containing material | 15 |
| | |
| Chapter 2: Risk Assessment Part 2: Health Effects, Exposure Assessment, and Risk Characterisation | 17 |
| Main points | 17 |
| Potential for non-occupational human exposure | 17 |
| Possible health effects | 18 |
| Exposure assessment | 20 |
| Risk characterisation | 21 |
| | |
| Chapter 3: Risk Communication | 23 |
| Main points | 23 |
| | |
| Chapter 4: Risk Management | 25 |
| Main points | 25 |
| Risk management | 25 |
| Summary of the <i>Graded Response Protocol</i> | 25 |
| Background to the <i>Graded Response Protocol</i> | 26 |
| Graded Response Protocol | 28 |
| | |
| Chapter 5: Roles and Responsibilities | 36 |
| Role of the public health unit | 36 |
| Role of territorial authorities | 38 |
| Role of property owners | 41 |
| | |
| References | 43 |

Appendices

| | |
|--|----|
| Appendix 1: Asbestos Sampling and Analysis | 46 |
| Appendix 2: Report Sheets | 51 |

Glossary

63

List of Tables

| | |
|--|----|
| Report Table 1.2: Actions or potential for damage, disturbance or erosion | 54 |
| Report Table 2.4: Characterisation | 58 |
| Report Table 2.6: Potential for future damage, disturbance or erosion and suggested action | 59 |
| Report Table 3.4: Exposure estimation | 61 |

Introduction

Background

Nearly a century ago the adverse effects on health caused by the inhalation of asbestos fibres were recognised in the United Kingdom. Fibrosis of the lungs amongst asbestos cloth workers was further observed and the term asbestosis coined in the 1920s. The need for regulatory action was recognised in 1931 by the United Kingdom Government, and Asbestos Industry Regulations came into full force in 1933.

In New Zealand, prior to World War II, products containing asbestos were imported but not manufactured. It was not until after the war, with the production of asbestos-cement building materials, that manufacturing involving asbestos commenced in any volume.

In 1964 a New Zealand occupational standard was set for asbestos fibres in air and, in 1984, the import of raw friable crocidolite and amosite was banned by a Custom Prohibition Order. In 1989 this ban was extended to chrysotile and was confirmed again in 2005 by Customs Import Prohibition Order. The New Zealand Customs Service is the agency responsible for administering the Customs and Excise Act 1996.

Until the 1980s concerns in developed countries about asbestos were primarily related to the gross occupational exposures that had formerly taken place and the legacy of asbestos-related occupational disease that was still emerging after long latency periods.

However, asbestos exposure may also occur to a limited degree through para-occupational exposure, such as living in the vicinity of asbestos-related industries or bringing home contaminated clothes, tools, etc. The general population may also be exposed if they live close to an asbestos-containing waste site or may be exposed from a variety of asbestos-containing products, from poorly performed asbestos removal, or from living with deteriorating asbestos material.

Public agencies found they needed to respond to the new public interest in asbestos, particularly where it occurred in such places as schools. For example, in the USA, Australia and New Zealand, programmes to manage asbestos risks in schools and hospitals began in the early 1980s. In New Zealand, a report by the Asbestos Advisory Committee was made to the Minister of Labour in April 1991 (OSH 1991).

Some public concern continues to be expressed about asbestos-cement products, which were used widely in New Zealand buildings until the mid 1980s. These products normally provide a matrix that binds asbestos fibres, preventing their release, but drilling or sawing, especially with power tools that disturbs or damages the material can lead to fibres being released into the air. There is concern that the fibres released by such mechanical work may be a hazard to health.

Purpose of the guidelines

The guidelines provide guidance to public health units (PHUs) that contribute to the management of risks to health from asbestos in non-occupational settings. People may be exposed to asbestos in non-occupational settings, primarily in and around the home.

Properly applied, the guidelines will assist with determining:

- the risk of an asbestos hazard
- appropriate advice on managing the risk, including risk communication.

In the non-occupational setting, asbestos exposure is unlikely to present a high level of risk. If exposure is encountered the affected person should be encouraged to inform their medical advisor. People affected by occupational or para-occupational exposure may have heightened concerns about asbestos and require health counselling or other support.

Management of enquiries concerning asbestos

The number of agencies that are potentially involved when members of the public make enquiries concerning asbestos often leads to confusion and frustration. The usual agencies involved are public health units, regional councils, Department of Labour and territorial authorities.

This guideline provides guidance to PHUs on how to approach asbestos enquiries and how to manage interagency involvement. These measures will require co-operation and co-ordination at a local level by each agency and should involve formal agreements on how to proceed. Identifying a lead agency in any given set of circumstances may be required. The following issues need to be addressed.

- Is the issue about public health?
- Is the issue about worker safety?
- Identify the lead agency in any particular instance.
- What role do other agencies have?

Is the issue about public health?

Public health means the health of all of:

- the people of New Zealand
- a community or section of people.

The public health role is managed by the public health units of the district health boards (DHBs) as contracted by the Ministry of Health and defined in the New Zealand Public Health and Disability Act 2000 (NZPHD).

Asbestos issues or hazards have a general and a specific component derived from sections 22 and 23 of the NZPHD.

1. The **general component** is derived from section 22 of the NZPHD, which sets out the objectives of DHBs.

22(1) Every DHB has the following objectives. (Amongst others)

- (a) to improve, promote and protect the health of people and communities.

For asbestos this obligation will be met by:

- responding to public (non-occupational) enquiries
- providing technical information and advice on asbestos-related matters
- directing enquiries/complaints to an appropriate lead agency
- investigating asbestos situations that may have public health implications
- investigating non-occupational asbestos disease notifications.
- responding to emergencies involving asbestos in a non-occupational setting.

2. The **specific component** is derived from section 23 of the NZPHD – Functions of DHBs:

- (h) to promote the reduction of adverse social and environmental effects on the health of people and communities.

This specific public health role relates to the definition of public health as ‘a community or section of such people’. These people are the people not covered by statutory responsibilities of other agencies in relation to asbestos and public health.

The other agencies that have public health responsibilities relating to asbestos are:

- Department of Labour (Health and Safety in Employment Act 1992; the HSE Act)
- regional councils (Resource Management Act 1991; the RM Act)
- territorial authorities (Health Act 1956, Building Act 2004).

Each of these agencies is the lead agency under its legislation. PHU staff need to be careful to avoid taking the lead role in situations that are properly the responsibility of the affected person or of other regulatory agencies.

Is the issue about worker safety?

These guidelines exclude the following settings and activities:

- places of work
- ambient (outside) air
- drinking-water
- manufactured mineral fibres.

The Department of Health and the Department of Labour jointly administered the Asbestos Regulations 1978 through to 1983. In 1983 new regulations were then prepared to take notice of changes in attitudes to asbestos. With the advent of the Health and Safety in Employment Act 1992 and changes to how workplace health and safety were to be managed, the Asbestos Regulations were once again amended in 1998 and became the sole responsibility of Department of Labour. In effect, all activities involved with asbestos were to be managed under the all-inclusive workplace regime. The only area not covered concerns the private person in their own home and these guidelines deal with this area.

Department of Labour (formerly Occupational Safety and Health; OSH) has prepared guidelines for working with asbestos. Readers are encouraged to read them to understand the procedures for safe working with asbestos in any environment. (See <http://www.dol.govt.nz>.)

Places of work are covered by the HSE Act. Department of Labour is responsible for enforcing the HSE Act. The home, public buildings and schools may be places of work if contractors are doing work in them. Section 15 of the HSE Act covers responsibilities of employers who are not employees; for example, *Every employer shall take all practicable steps to ensure that no action or inaction of any employee while at work harms any other person.*

Identify the lead agency in any particular instance

Ambient (outside) air is covered by the Resource Management Act 1991. The Ministry for the Environment administers the RM Act and regional councils implement the RM Act in so far as it relates to the discharge of contaminants to air. Asbestos also occurs in ambient air from natural sources and sources like vehicle brakes. The management of such diffuse sources of exposure is not considered in these guidelines but the PHU should be aware of them. Ambient air inside dwellings and point source release of asbestos around dwellings would, however, be covered by these guidelines. Drinking-water is covered by the *Drinking-water Standards for New Zealand* (Ministry of Health 2005).

Risk analysis

Most asbestos situations will involve personal health issues and will be related to a single person or a family. PHU advice can be given in these cases if workers are not involved. PHU staff need to take care to avoid becoming involved in situations that are properly the responsibility of the person affected or other agencies.

If it is considered that the PHU should be involved, a risk analysis may assist in the decisions to be made.

A public health risk analysis model is outlined in *A Guide to Health Impact Assessment* and forms the basis for these guidelines (Ministry of Health 1998). There are three sequential steps in the process of decision-making regarding risk:

1. risk assessment
2. risk communication
3. risk management.

Risk assessment asks: ‘What are the risks?’ and ‘Who will be affected, how, and to what extent?’ It includes hazard identification, dose–response assessments, exposure assessment, and risk characterisation.

At the first step in the risk assessment process, hazards have to be identified. If the assessment of the hazard suggests that the likelihood of a risk is small, or that control is straightforward and safe, it may not be necessary to proceed to the quantification of risk. It is generally accepted that the risk from exposure to asbestos in the non-occupational environment is likely to be low.

The second step in risk assessment is the consideration of dose–response of the health effects from exposure to the identified hazards. Dose–response models are developed from occupational data and extrapolated to low levels of exposure. The dose–response models that are used are subject to considerable debate about the validity of the assumptions made. Because of the low levels of exposure from non-occupational sources of asbestos, these guidelines refer to ‘health effects’ in general rather than dose–response relationships.

The next step in risk assessment considers who might be exposed and their characteristics, the routes of exposure and the extent, duration and frequency of the exposure to the hazards identified.

The information from these three steps is used in risk characterisation, the final step of risk assessment.

The acceptability of risk is a decision for either individuals or society as a whole. Without societal judgements about acceptable risk, no decisions can be reached on proposals that carry both benefits and risks. On the other hand, individuals expect to suffer no more than negligible harm from environmental hazards, unless they are taking voluntary risks in the pursuit of some activity in which they see benefits. Various scientific and regulatory bodies have set levels of what they consider to be acceptable risks, but it is uncertain whether these levels will be understood or accepted by individuals.

Although risk assessment and risk communication are discussed separately (see Chapter 3), these two other steps in risk analysis need to be integrated in the delivery of services. During any communication of risk, there must be adequate consultation on the risks, and public concerns must be taken into account. Risk management seeks to address the following questions: ‘How can risks be avoided or reduced?’, ‘What are the options?’, ‘Are contingency and emergency plans adequate?’, ‘How can differing perceptions of risk be mediated?’ and ‘Can future health risks be predicted?’

Further information

Much of the information in the guidelines has been drawn from publications referred to in the references, in particular:

- *Asbestos and Other Natural Mineral Fibres*, Environmental Health Criteria 53 (WHO 1986)
- *Asbestos in Public and Commercial Buildings: A literature review and synthesis of current knowledge* (HEI 1991)
- *Guidance for Controlling Asbestos-containing Materials in Buildings* (the ‘Purple Book’) (US EPA 1985)
- *Managing Asbestos in Place* (the ‘Green Book’) (US EPA 1990)
- *Non-Occupational Exposure to Mineral Fibres*, IARC Scientific Publications No. 90 (Bignon et al 1989)
- *Reduction of Asbestos in the Environment* (IPCS 1989)
- *Toxicological Profile for Asbestos* (ATSDR 2001).

A more recent publication with useful information is *Management of Asbestos in the Non-occupational Environment* (Department of Health and Ageing 2005).

Chapter 1:

Risk Assessment Part 1: Hazard Identification

Main points

- Asbestos (actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite) has been classified by the International Agency for Research on Cancer (IARC) as being carcinogenic to humans.
- Asbestos fibres have always existed naturally in air due to weathering of asbestos bearing rock; ie, there is a natural background level of asbestos fibres in air.
- Normal healthy human lungs can contain significant loading of fibres without harm (Berry et al 1989).
- The risk from exposure to asbestos in the non-occupational setting is considered to be low.
- Asbestos has many useful properties and has historically been a component in a wide range of products. The industrial use of asbestos in manufactured articles has almost ceased and spraying of asbestos is no longer permitted.
- The presence of asbestos in materials cannot be determined definitively by visual inspection.
- All moulded fibre-cement products (eg, corrugated sheet) should be treated as containing asbestos. Treat any other fibre cement products (including building cladding, panel fences, insulating board and roofs) installed before 1985 as containing asbestos unless otherwise excluded by testing.
- Textured coatings (generally on ceilings) installed after 1964 and up to 1984 are likely to contain asbestos. Treat as friable unless proven otherwise.
- Vinyl or 'Lino' floor coverings (which may also be used on other surfaces) installed up to 1989 may contain asbestos in the backing material. (All floor coverings installed prior to the late 1980s may contain asbestos.)
- Public buildings are likely to contain materials not commonly found in housing, such as sprayed insulation on structural steel or heating pipe insulation. These may contain asbestos that may be friable.
- Sprayed-on (friable) insulation poses a higher risk of exposure to asbestos fibres as it becomes airborne easily compared with fibres bound in a matrix. This type of high-risk asbestos is highly unlikely to be found in the home.
- Any material suspected of containing asbestos should always be tested before any action is taken that could lead to the release of fibres.
- Asbestos should be removed by a certified professional where friable, and where exposed at demolition or alteration of buildings.
- Property owners should seek expert advice if work with asbestos-containing materials is required. Under the Health and Safety in Employment (Asbestos) Regulations 1998 all people working with friable asbestos must have a Certificate of Competence issued by Department of Labour. To obtain a certificate these operators must demonstrate to Department of Labour that they have the expertise, knowledge and equipment necessary to undertake work involving asbestos safely.

Asbestos

Asbestos is a common term describing a variety of naturally occurring hydrated silicate minerals containing SiO_4 groups linked into chains, which exhibit properties rendering them useful in manufactured products. The most important forms of asbestos (as shown below) belong to the serpentine group, of which chrysotile is the most commonly used.

| | |
|-------------------------|---|
| Serpentine Group | Chrysotile (white) |
| Amphibole Group | Crocidolite (blue) Amosite (brown) |

All forms of asbestos can cause cancer, but the amphiboles are more potent than chrysotile. Amphiboles are generally brittle and often are shaped like a rod or needle, whereas chrysotiles are flexible and curved. Their needle-like fibres can easily penetrate through to the respiratory tract (breathing pipe) and lungs and are most likely to cause health problems. Chrysotile asbestos is thicker due to the curly nature of the fibres, and unable to penetrate as far.

Two characteristics that asbestos materials have in common are their capacity to persist in lung tissue for months, if not for years, and their physical characteristics. The physical characteristics of asbestos fibres are responsible for their adverse effects. The length of the fibres is often more than $5\ \mu\text{m}$ (microns), their width is less than $3\ \mu\text{m}$ and the length to width ratio is not less than 3 to 1. These properties of asbestos fibres make them accessible to lung tissues through inhalation.

The most commonly mined forms of fibrous asbestos are chrysotile, an iron–magnesium silicate white in colour; crocidolite, an iron–sodium silicate blue in colour; and amosite, an iron and magnesium silicate grey-brown in colour. Actinolite, tremolite and anthophyllite occur in both fibrous and non-fibrous forms and have rarely been mined as commercial asbestos.

Both the fibrous and non-fibrous forms of amphibole minerals are sometimes found as contaminants of chrysotile, sheet silicate (talc and vermiculite) and other minerals. Tremolite, in particular, may occur as a contaminant in other forms of asbestos including chrysotile, and has been implicated in health effects that may not occur from pure chrysotile.

The morphology of the asbestos fibres differs between the groups. Both groups are naturally fibrous but the sizes (length and width) and the shapes of industrial fibres differ.

Chrysotile fibres are a bundle of thousands of agglomerated fibrils, which in section appear like a scroll of paper resulting in a vast surface area and possess elasticity, flexibility and good tensile strength. Chrysotile fibres have a width of $0.1\text{--}1.0\ \mu\text{m}$ (fibrils less than $0.020\ \mu\text{m}$) and are thinner and curlier compared with those in the amphibole group.

The amphibole group are straight, hard, sharp, needle-like structures that may break longitudinally to form very fine fibrils. Crocidolite retains good flexibility and has high tensile strength. Fibres are $1\text{--}2\ \mu\text{m}$ in width (fibrils $0.08\text{--}0.10\ \mu\text{m}$) and up to $70\ \text{mm}$ long. Amosite fibres are quite flexible and are weaker than the other forms. Fibre width is $1\text{--}2\ \mu\text{m}$ (fibrils $0.100\ \mu\text{m}$) and length is up to $70\ \text{mm}$.

The physicochemical properties of importance in industry include:

- incombustibility
- high tensile strength
- resistance to high temperatures
- low thermal conductivity
- resistance in varying degrees to dissolution, or breakdown by strong acid, alkali or enzymes in the body
- resistance to micro-organisms
- resistance to wear
- electrical resistance.

Amphibole fibres are resistant to both acids and alkalis and generally extremely durable even in aggressive chemical environments. All forms of asbestos are resistant to alkalis.

These properties of asbestos have made it useful for adding tensile strength to composite materials, and for use in materials that need to resist heat, chemical attack and wear. Because of its fibrous nature and low thermal conductivity, asbestos is also useful as insulation. For many applications it is difficult, costly or impossible to substitute asbestos with other equally suitable materials.

Fibres obtained from asbestos ore are classified into 150 grades (the Quebec Standard), each corresponding to a specific use in the manufacture of asbestos-based products. The shortest milled asbestos is generally used in moulded goods, such as asbestos-cement products. The longest fibres are used in asbestos textiles.

Milling and other physical treatment not only break up bundles of fibres but also lead to the breakage of fibres along their length, resulting in thinner, shorter fibres (fibrils) that may penetrate deep into the lungs.

Asbestos fibre dimensions and type

Length and width of fibres

The concentrations given in this chapter are for fibres greater than 5 μm in length, as these are of greatest health significance (see Chapter 2). Recent reviews of fibre sizes have concluded that the shorter fibres present low or no risk to human health (ATSDR 2003).

A particle visible under phase contrast microscopy (PCM) is counted as a fibre if it is $\geq 5 \mu\text{m}$ long and has a length/thickness ratio of $\geq 3:1$. PCM cannot detect fibres thinner than about 0.3 μm and cannot distinguish between asbestos fibres and other fibres (NIOSH 1987). In non-occupational settings where large proportions of other fibres (eg, wool, cotton, glass) are present, PCM will overestimate the asbestos fibre concentration. In addition, the sensitivity of PCM is approximately 0.01 f/mL. This concentration of asbestos fibres is higher than that generally found in the non-occupational environment (ATSDR 2001).

Transmission electron microscopy (TEM) or scanning electron microscopy (SEM) methods are used to determine the fibre type. However, TEM and SEM are not as useful for counting fibres

as they are inaccurate and cannot distinguish readily between fibre sizes. Accuracy is particularly limited with long (> 5 µm) fibres (ATSDR 2001).

When gravimetric measurement of fibre concentrations is used, a large proportion of the fibres may not be of great significance to health because the method does not distinguish between different types of fibres and their size.

In combination, PCM, SEM and/or TEM provide a good tool to determine the number and type of fibres sampled using air monitoring. PCM determines that the fibres are within the appropriate width category and SEM and TEM determine the fibre type.

Note: when considering reported fibre concentrations, it is important to clarify, where possible, the criteria used in counting the fibres and the method of sample collection and preparation.

Type of asbestos in asbestos-containing materials and air

After about 1960, chrysotile was predominantly used in asbestos-containing materials in buildings such as asbestos-cement products, decorative coatings, vinyl sheet floor covering (Lino) and tile flooring. Crocidolite and amosite are also likely to be present, though in smaller amounts, in products prior to about 1960.

Reported concentrations of asbestos fibres in air in various environments seldom identify the type of asbestos. In contrast to chrysotile, the presence of amphibole fibres in rural and urban samples is rare and is usually the sign that some specific local source (or laboratory contamination) is present (HEI 1991).

With few exceptions, the type of asbestos fibre found in public and commercial buildings is chrysotile. Some buildings may have sprayed friable crocidolite or amosite (Mossman et al 1990).

Despite the pervasiveness of chrysotile, it is necessary to determine the type of asbestos in an asbestos-containing material. The type appears to be unimportant in the development of lung cancer, but the presence of amphibole asbestos is a very important factor in mesothelioma. Thus it is important to determine whether chrysotile is contaminated with amphibole.

Asbestos-containing materials

Because of their exceptional insulating, fire-resistant and reinforcing properties, asbestos-containing materials have been utilised widely: in buildings in surface-applied finishes (for acoustical, decorative and fire-retardant purposes); in asbestos-cement products in sheet and other moulded forms; as thermal insulation in the construction of buildings; as well as in equipment used in buildings.

Over the last 20 years the removal of sprayed-on asbestos insulation materials from public buildings has increased and now few buildings still have this material. Decorative coatings in buildings and homes have also been largely removed as redecorating becomes necessary. Much asbestos-backed floor covering has been removed as well but, due to the difficult nature of this

activity, some floor coverings have been overlaid with new coverings. By far the largest quantity of asbestos-containing materials around today is asbestos-cement roofing and wall cladding. These materials usually do not present a high risk unless they are disturbed. To a considerable extent, too, they are gradually being removed as upgrading or demolition takes place.

The presence of asbestos in materials cannot be determined definitively by visual inspection. Actual determinations can only be made by instrumental analysis (PMC, SEM, TEM). It is best to assume that the product contains asbestos until laboratory analysis proves otherwise.

In the home the primary asbestos-containing materials are:

- surfacing materials (such as asbestos-cement products used for cladding and roofing, and decorative/textured internal coatings on ceilings)
- thermal and fire insulation
- moulded materials (such as asbestos-cement products for gutters and down-pipes)
- electrical backboards
- backings to vinyl sheet floor coverings, and in the matrix of vinyl tiles.

Much less common asbestos-containing material may occur in the home as:

- lagging or insulation in old heating appliances, or around pipes and older hot water cylinders
- some external textured coatings
- plastic products, caulking and other composites
- a woven sheath around old vulcanised India rubber insulated wiring
- built-up roofing felts.

Old household items with asbestos-containing material may include: asbestos simmer mats for stoves; oven gloves; mats on ironing boards; fire blankets and other asbestos textiles; electric heaters, hair dryers and older model toasters. All these items are unlikely to be in common use today.

Other sources of asbestos dust in the home may include dust from automotive friction materials or take-home dust from occupational exposure to asbestos.

In public buildings used as workplaces, asbestos-containing material may occur as:

- surfacing materials (eg, sprayed or trowelled asbestos-containing material on surfaces such as decorative finishes on ceilings, fireproofing materials on structural members, acoustical asbestos-containing material on the underside of concrete slabs or decking, and fire- and heat-resistant linings to boiler rooms)
- thermal system insulation (lagging and moulded insulation of heating and cooling service pipes, ducts, boilers and tanks to prevent heat loss, gain or condensation, and thermal insulation coatings or layers in the structure)
- miscellaneous asbestos-containing material such as asbestos-cement panels, cladding, roofing, pipes and other mouldings, asbestos-containing ceiling or floor coverings, and incidental uses in packings, friction materials, textiles, plastics reinforcement, gaskets and filters.

Asbestos-cement products

Composite materials containing Portland cement, sand and some form of fibrous reinforcement may generically be called 'fibre-cement' products. These products occur in housing and public buildings.

Chrysotile, in particular, is resistant to alkaline cement, which gives it an advantage over other reinforcing fibres. More recently, cellulose fibres have replaced asbestos in the makeup of a proprietary product called *Hardiflex*.

In asbestos-cement products, the asbestos fibres are bound in the cement/sand matrix, often in small bundles just visible to the naked eye (usually about 10–12 percent asbestos). The material tends to become more brittle with age. Surface deterioration can occur due to acid rain, abrasion, or persistent damp conditions aided by organic growths.

Products typically used in housing included *Fibrolite* (from 1972 to 1982), *Durock* (up to 1974), *Coverline* or *Highline* profiled sheets (1972 to 1982), *Hardiflex* or *Hardiplank* (up to 1982), *Harditherm* (1972 to 1982) and *Durotherm* (up to 1974). Note that *New Hardiflex* (used from 1982 to the present day) does not contain asbestos.

The *Fibrolite*, *Durock* and *Polite* mix was similar and contained chrysotile and a small amount of amosite. The mix was mouldable into corrugated and other forms such as gutters. Early products, up to the 1950s, probably contained crocidolite and the percentage of asbestos was higher, reputedly up to 50 percent. *Hardiflex* was not a mouldable material but was more flexible. (Fletchers produced an equivalent product, some of which was in the form of siding.) Sheet material may be found internally as linings in wet areas such as bathrooms, or in storage areas, occasionally as bench tops. *Harditherm* and *Durotherm* (22 percent asbestos) were used for fire protection and insulation. They were softer and easily nailed; they may become friable at the edges.

Summary of uses

1. Roofing: bold roll corrugated sheet (*super 6*); narrow roll corrugated sheet, shingles
2. Walls: shingles, flat sheet (generally 9 mm), profiled sheet (eg, *Coverline* and *Hiline*)
3. Ancillary: guttering and down-pipes in various sizes, other moulded items (eg, garden troughs), roofing components (eg, verge and ridge trim)

Decorative coatings

Decorative internal coatings produced between 1964 and 1983 generally contained 5–9 percent chrysotile asbestos, and were applied as textured ceilings in housing and public buildings. The coating was able to mask imperfections in a substrate otherwise unsuitable for paint finishes. In public buildings, similar coatings were applied for decorative and/or acoustic purposes on ceilings and other surfaces out of reach. Use of product containing asbestos probably ceased around 1984.

The asbestos fibres and other fillers (such as expanded vermiculite and polystyrene) were bound together with adhesives to form the product. Portland cement was not included.

Trade names of decorative coatings include *Glamortex* and *Whispar*. Licensed contractors were generally used by the producers of the products. Nuplex Industries, for example, are able to identify from their records particular jobs, their dates and the contractors used.

The products up to the late 1970s may be beige in colour (those containing vermiculite or perlite); those from 1980 to 1983 may be white (containing expanded polystyrene granules). The coatings are rather soft, because of the expanded materials in them, and could be damaged by impact or abrasion. Despite the soft nature of the coating, the fibres are generally well bound in a matrix of adhesive and filler-binders unless damaged or disturbed, when the material can become friable. The coating may be softened by water, and any areas that have become damp could suffer deterioration and poor adhesion to substrates; after drying out the material may be friable.

External decorative textured coatings were also made, using resin binders. Use is likely to have ceased around 1984.

Vinyl tile and sheet

There are two categories of resilient floor coverings: sheet material, consisting of a polyvinyl chloride layer with a chrysotile paper backing, and floor tiles, in which chrysotile is uniformly dispersed throughout the material. Vinyl-asbestos floor tile is made of 15 percent polyvinyl chloride (and sometimes asphalt) as the thermoplastic binder, with 10 to 20 percent asbestos and other mineral additives and pigments. The products may have been installed up to 1989. When sheet material is removed, the backing tends to remain adhered to the floor by the glue layer, presenting problems for safe removal. Vinyl sheet floor covering may be referred to as *Lino*.

The vinyl-asbestos floor tile must be regarded as a special type of asbestos-containing material in that abrasion in normal use can release dust if not properly maintained. Properly waxed, these floor coverings can be considered as encapsulated. However, buffing, wax stripping and other abrasive treatments can cause the release of fibres. Unique analytical problems arise in examining dust from such floors, and most fibres are less than 3 µm in length (HEI 1991).

Asbestos-containing material generally only in larger buildings

The following are types of asbestos-containing material that are largely found only in larger buildings.

- **Acoustic plaster soundproofing** is a firm, open-pored, plaster-like material, applied by trowel. The soundproofing material is usually exposed and not painted.
- Asbestos-containing material used in **insulation used for thermal system insulation (TSI)** – air-conditioning ducts, hot and cold water pipes, hot water reservoirs, pressure tanks, and boilers – is generally covered with a fabric or metal jacket. Fire doors often contain laminates of asbestos materials covered by wood or metal. The asbestos-containing material enclosed by the outer coverings is likely to be friable. These are old techniques and unlikely to be found today.

- A number of methods of **lagging** have been used on boilers, condensate tanks and steam headers; and pipes carrying steam, hot and chilled water and condensate, including:
 - raw asbestos/water mixture (or pre-formed asbestos blocks attached to the underlying surface) with an outer layer of wire-netting reinforcement finished with a cement of fine clay/asbestos
 - pre-formed pipe lagging of asbestos-containing material, usually in two halves wrapped in calico and traditionally painted red or white
 - asbestos paste to finish lagging around valves and bends, and as repair to damaged areas.

These are older techniques that are not likely to be used today.

Non-occupational sources of the hazard

The following examples are typical of concentrations of fibres in various environments.

The outdoor environment

Typical concentrations of asbestos fibres in the outdoor environment provide a useful yardstick for comparison with indoor environments. Examples of reported values are 0.1 f/L (fibres per litre), with more than 0.1 f/L downwind of local sources, such as vehicle braking (ATSDR 1990; HEI 1991). Fibre concentrations (fibres > 5 µm in length) in outdoor air ranged between 0.1 and about 10 f/L, levels in most samples being less than 1 f/L based on surveys conducted in Austria, Canada, Germany, South Africa and the USA before 1986 (WHO 1998). A later survey carried out in Canada, Italy, Japan, the Slovak Republic, Switzerland, the United Kingdom and the USA showed means and medians of between 0.05 and 0.20 f/L (WHO 1998). The usual concentrations are 0.05 f/L in rural areas and up to 0.5 f/L in urban areas (ATSDR 2001).

In some circumstances, outdoor urban concentrations of asbestos fibres may be due to activities releasing asbestos in the neighbourhood, including diffuse sources such as vehicle braking. This source of asbestos is diminishing as asbestos-free brake linings are phased in. All new vehicles from about 2000 have asbestos-free brake linings and replacement linings are also changing to asbestos-free.

Residential buildings

Reported concentrations in residential buildings all relate to building with asbestos-containing materials, which were, or were suspected of being, friable or were being damaged. The concentrations ranged from 'not detected' to 2.0 f/L but were generally in the range of 0.2 f/L to 0.4 f/L (Bignon et al 1989; CPSC 1983; HEI 1991; WHO 1986). ATSDR (2001) suggests that the background indoor air levels average around 0.20 f/L.

Public buildings

Typical concentrations of asbestos fibres in public buildings, even those with friable asbestos-containing materials, are within the range of those measured in ambient air. Fibre concentrations (fibres >5 µm in length) in buildings in Germany and Canada reported before 1986 were generally less than 2.0 f/L. Mean values reported in more recent surveys in Belgium, Canada,

the Slovak Republic, the United Kingdom and the USA were between 0.05 and 4.5 f/L. Only 0.67 percent of chrysotile fibres were longer than 5 µm (WHO 1998).

Note: For comparison purposes, the workplace exposure standard (WES) for asbestos (set in the HSE (Asbestos) Regulations 1998) is measured in f/mL and for chrysotile is 1 f/mL. This is the level of contamination to which a worker can be exposed for 8 hours a day or 40 hours a week. The public health levels are expressed in fibres /litre, ie, 1 f/L, which is 1000 times lower than the occupational health standard in New Zealand of 1 f/mL.

Release of asbestos fibres from asbestos-containing material

In the majority of cases, intact asbestos-containing material is not a risk merely by its presence. Fibres are released when physical actions (deliberate or accidental) disturb the surface. Asbestos-cement materials will release fibres when sawed, drilled or otherwise worked or damaged. Materials such as asbestos-cement pipe can release asbestos fibres if broken or crushed when buildings are demolished. Other asbestos-containing material, such as decorative coatings, acoustic insulation and thermal system insulation, is vulnerable to damage during building maintenance operations, from vandalism and accidental damage. The use of power tools to drill and cut through asbestos-cement material can generate a significant number of airborne fibres.

Release of asbestos fibres during removal

During the disturbance and removal of friable spray-on asbestos in multi-storey buildings, high concentrations of asbestos fibres have been reported outside the enclosures where work was taking place (IPCS 1989). In the examples given, before work commenced, the background average concentration was less than 0.2 f/L. During the removal phase, concentrations outside the enclosures increased to between 14 and 290 f/L (generally around 70 f/L) then they declined over 16 to 35 weeks to between 1.0 f/L and 0.4 f/L. During a simulated maintenance activity on sprayed asbestos, a local concentration of around 30 f/L was observed. These results may be improved by the precautions now required of certified asbestos removal contractors, but they highlight the increased risk created by removal, which takes many months to abate. Such levels are unlikely to be reached during careful removal of asbestos-cement materials from the home. However, using electrical sanders to remove the backing material of vinyl sheet covering or Lino will produce significant airborne fibres.

Release of asbestos fibres during normal wear and weathering

Fibres can also be released naturally through corrosion and weathering of asbestos-cement products. The measurement of fibres released from corroded and weathered asbestos-cement products has been attempted by Spurney (Bignon et al 1989). Investigations measured the release of fibres in simulated wind speeds between 1 and 5 metres/sec. The results showed that:

- asbestos-cement surfaces corrode and weather as a result of **aggressive** atmospheric pollution (eg, sulphur dioxide, aerosols and acid rain) in proportion to the acidity of the rain and concentration of pollutants
- the surface cement matrix is destroyed and a layer approximately 0.1–0.3 mm of free fibres is built up and bundles of fibres are visible to the naked eye

- wind can disperse the fibres into the ambient air with emissions in the range 10^6 to 10^9 fibres per square metre per hour (with rates affected by pollution intensity and weather)
- about 20 percent of fibres are dispersed in the air and 80 percent washed out by rain
- there were crystallographic changes in the corroded chrysotile fibres, and pollutants (metal and organic substances) were deposited on the free fibres
- the fibres released had approximately the same carcinogenic potential as uncorroded chrysotile
- fibre concentrations in the vicinity of buildings with corroded and weathered asbestos-cement products (fibres greater than $5\ \mu\text{m}$) were from 0.2 to 1.2 f/L – ie, well below the workplace occupational exposure standards.

A study on asbestos-cement products in Western Australia found that deteriorating asbestos-cement roofs were common and that asbestos was present in the gutters and run-off water. The highest concentration of asbestos was from roofs 10–17 years old; younger and older roofs produced lower concentrations. Air monitoring at nine sites suggested that the air concentrations are likely to be less than 2.0 f/L and more likely to be less than 0.2 f/L (Western Australian Advisory Committee on Hazardous Substances 1990).

Elevated levels of fibres have been detected following the use of high pressure jets for cleaning asbestos-cement roof surfaces. These fibres may be deposited on soil and other surfaces around the home and create an increased risk of airborne fibres when dry.

Drinking-water and precipitation

There is a theoretical possibility of exposure to airborne asbestos from drinking-water aerosols and dried asbestos deposits. Where significant fibre concentrations were found, the fibre length median was generally between 0.5 and $1.0\ \mu\text{m}$, although fibres greater than $5\ \mu\text{m}$ were present (HEI 1991). Air measurements were made in some homes using water containing 24 million f/L and in other homes containing 1.1 million f/L. Mean values from a combination of background, showering and vacuuming activities showed that homes with the more polluted supply gave fibre and mass concentrations about four times higher than the ones with the less polluted supply. No data on exposure from this source have been found.

Most asbestos fibres in water are chrysotile and are $< 5\ \mu\text{m}$ in length (ATSDR 2001). Available data on effects of exposure to chrysotile asbestos specifically in the general environment, including data from ecological studies of populations in Connecticut, Florida, California, Utah and Quebec and from a case-control study in Puget Sound, Washington State, are restricted to those in populations exposed to relatively high concentrations of chrysotile asbestos in drinking-water, particularly from serpentine deposits or asbestos-cement pipe. WHO (1998) concluded that convincing evidence of an association between asbestos in public water supplies and cancer induction was scant.

Chapter 2:

Risk Assessment Part 2: Health Effects, Exposure Assessment, and Risk Characterisation

Main points

- Exposure to all forms of asbestos at sufficiently high concentrations of airborne fibres increases the risk of asbestos-related diseases but amphibole forms of asbestos are considered to be more hazardous to health than chrysotile.
- The risk from exposure to asbestos in the non-occupational setting is considered to be low because the concentrations of airborne asbestos fibres are low.
- Fibre concentration in air, length, width and composition are critical determinants of carcinogenic potency.
- Sampling and analysis of asbestos-containing materials aim to identify the type(s) of asbestos in an asbestos-containing material or in air, and to measure exposure by determining the concentration of asbestos fibres in air.

Potential for non-occupational human exposure

Inhalation is the primary route by which the general population might be exposed to asbestos. Small quantities of asbestos fibres are ubiquitous in air, arising from natural sources (weathering of asbestos-containing materials), windblown soil from hazardous waste sites, deterioration of automobile clutches and brakes, or breakdown of asbestos-containing materials. The levels of asbestos in dust and wind-blown soil may be higher for those living close to a site for mining or processing asbestos and certain other ores, or a building containing asbestos products that is being demolished or renovated, or a waste site where asbestos is not properly covered.

The highest risk of exposure to asbestos in the home is through home renovating, by cutting or drilling through asbestos-cement sheeting or sanding down asbestos-containing Lino or tiles. Left undisturbed, such materials pose a negligible risk; therefore it is recommended that asbestos-containing material in good condition be left alone.

There is an ongoing, although low, risk of exposure to asbestos fibres in a home from damaged or deteriorating asbestos-containing insulation, walls, ceiling or floor tiles. Friable asbestos (which would crumble easily if handled) is more likely to generate airborne fibre, hence increasing the risk of exposure to asbestos. The risk of generating airborne asbestos fibres can be reduced by appropriate management measures (eg, removing the friable material or sealing the surface).

Older buildings may include asbestos-containing material, which had been used for insulation, surface treatment (eg, fireproofing), floor and ceiling tiles, insulating boards, and spackling, patching, and plastering compounds; and asbestos levels are generally higher in indoor air than outdoors (HEI 1991; Spengler et al 1989). Exposure appears to be low regardless of whether the buildings do not have asbestos-containing material, or have asbestos-containing material in good condition, or have damaged asbestos-containing material (Spengler et al 1989).

The levels of airborne asbestos in buildings, even with damaged asbestos-containing material, are lower – by several orders of magnitudes – than concentrations in the unregulated workplace in the past and approximately 100 times lower than the current permissible exposure in the workplace. Recent epidemiological studies of deaths from mesothelioma in the general population also suggest that risk from asbestos in buildings is negligible (Mossman et al 1990).

There remains the possibility that individuals engaged in asbestos-related activities – such as renovating or demolishing buildings with damaged or deteriorating asbestos – could bring asbestos into the home.

Ingesting asbestos may be harmful but this mode of exposure has not been clearly documented.

Possible health effects

The inhalation of airborne asbestos at concentrations that have been encountered in occupational settings in the past is known to have caused fibrosis of the lungs and pleura, as well as cancer of the lungs, pleura and peritoneum and, possibly, at distant sites. However, it is generally accepted that asbestos in non-occupational settings is not a significant risk.

Asbestosis

Asbestosis refers to diffuse or multi-focal fibrosis (scarring) in the lungs caused by the inhalation of asbestos fibres. It is considered that this disease only occurs in those who have been exposed to considerable concentrations of asbestos over a long time. The symptoms do not usually appear until about 20 to 30 years after the first exposure to asbestos. The person develops an insidious onset of shortness of breath and dull chest pains. Fibres penetrating to the peripheral air spaces initiate alveolitis, which, if chronic, results in scarring and fibrosis. The extent of lung inflammation and destruction is related to the amount of asbestos retained in the lungs, the fibre type and length, and individual susceptibility. Some evidence suggests that more retained asbestos is required to produce asbestosis than to produce asbestos pleural plaques.

The risk of asbestosis is insignificant for those who do not work with asbestos. The disease is rarely caused by neighbourhood or family exposure (US EPA 2007). High fibre doses (25–100 f/mL/yr) are generally required to produce clinically significant asbestosis within an individual's lifetime, with milder fibrosis at lower dose levels (Smartt 2004). Asbestosis is a marker of high asbestos exposure in individuals and its prevalence is a potential indication of high exposure in populations.

Non-malignant pleural conditions

Pleural plaques, and the less common diffuse pleural fibrosis, have been correlated with higher lung burdens of amosite, crocidolite and probably chrysotile than those of the general population. Cases are often asymptomatic. They tend to develop after long latency periods, usually more than 20 years after exposure. Prevalence is related to duration of exposure and possibly to peaks of exposure. There is some association of pleural plaques and diffuse pleural fibrosis with higher incidence of lung and larynx cancer (HEI 1991).

Benign diseases of the pleura may be the only manifestations of exposure to asbestos (occupationally and even non-occupationally). They are, therefore, considered to be important

as they are likely to be the most common way in which those affected by asbestos could be identified (HEI 1991).

Carcinoma of the lung

Epidemiological studies in the occupational setting have confirmed an association between asbestos exposure and lung cancer, even in non-smokers. This association is considered causal, although the rates in various studies have differed. The latency period is measured in years and appears to be directly related to cumulative exposure. Asbestos workers who smoke are about 90 times more likely to develop lung cancer than people who neither smoke nor have been exposed to asbestos (US EPA 2007). Exposure to asbestos in combination with cigarette smoke results in a more than additive risk of lung cancer.

The most common form of cancer caused by asbestos is bronchogenic carcinoma or lung cancer. Typically the person will develop a combination of symptoms, including shortness of breath, coughing and bloodstained sputum. The tumours are indistinguishable from those caused by other agents such as tobacco smoke or radon decay products. Cumulative dose is the main factor and all forms of asbestos should be considered equally potent. High incidence rates of lung cancer have been documented among people with short, intense exposure to amosite.

Mesothelioma

Mesothelioma is a rare cancer of the cells lining body cavities. It is the classic tumour associated with asbestos exposure, and appears to be unrelated to smoking (Doll and Peto 1985). Epidemiological evidence shows that approximately 70 to 90 percent of mesothelioma cases can be related to asbestos exposure (Youakim 2005).

Cases of death from mesothelioma have been reported in studies of workers or of people exposed environmentally to each of the main types of asbestos, predominantly chrysotile, amosite, crocidolite and tremolite. However, there are several studies that suggest that amphibole asbestos (tremolite, amosite and crocidolite) may be more potent than chrysotile despite the suggestion from some studies that all asbestos types can cause mesothelioma (ATSDR 2001).

The latency period is usually 35 to 40 years or more from the time of first exposure, although shorter periods have been recorded. The initial symptom is likely to be chest pain. Most cases have been associated with occupational exposure to asbestos or contact with contaminated clothing of asbestos workers (IARC 1987).

Key factors affecting fibre uptake and toxicity

For a given concentration of asbestos in air, fibre length, width and composition are critical determinants of carcinogenic potency. In general, fibres with a maximum carcinogenic potency have been reported to be no more than 8 µm in length, and less than 1.5 µm in width (IPCS 1989).

Characteristics of carcinogenic fibres

The main characteristics of carcinogenic fibres may be summarised as follows (Bignon et al 1989).

- No particle should be described as a fibre unless it is at least 5 µm long and its width is less than one-third of its length. Shorter particles (which should be properly described as elongated particles) are much less carcinogenic, if they are carcinogenic at all.
- The great majority of so-called fibres normally found in air, in and out of doors, are less than 5 µm in length.
- Asbestos may only be a complete carcinogen for the mesothelium (ie, causing mesothelioma), and may act to produce bronchial carcinoma less directly.
- The essential difference between long and short fibres would seem to be that fibres longer than 10 µm are entrapped by the cilia in the middle and upper respiratory tract and expelled in sputum, whereas fibres shorter than 3 µm are removed more readily by macrophages.

Exposure assessment

A knowledge of exposure is essential for environmental epidemiology and hazard control. Asbestos exposure affects not only asbestos workers but also their families, users of asbestos products, and members of the public who are exposed to building materials and asbestos in heating and ventilating system (LaDou 2004).

Exposure pathways

Inhalation exposure

Inhalation is the primary route by which the general population might be exposed to asbestos. Small quantities of asbestos fibres are ubiquitous in air, arising from natural sources (weathering of asbestos-containing materials), windblown soil from hazardous waste sites, deterioration of automobile clutches and brakes, or breakdown of asbestos-containing materials.

Non-occupational exposures may also occur by way of para-occupational exposure. In some of these cases, workers' families may inhale asbestos fibres released by clothes that have been in contact with asbestos-containing material. In other cases, people who live or work near asbestos-related operations may inhale asbestos fibres that have been released into the air by the operations.

Oral exposure

The adverse effects following ingestion of asbestos have not been clearly documented. However, there is some evidence that acute oral exposure may induce precursor lesions of colon cancer, and that chronic oral exposure may increase the risk of gastrointestinal tumours (ATSDR 2001). The National Academy of Sciences (NAS 1983) and United States Environmental Protection Agency (US EPA 1980) estimate that the lifetime ingestion of water containing 1.0 MF/L (million fibres per litre of water) would result in an excess incidence of gastrointestinal cancer of about 1–10 cases per 100,000 people exposed.

No studies were located regarding death in humans or animals after acute or intermediate oral exposure to asbestos (ATSDR 2001).

Dermal exposure

Asbestos fibres can penetrate into the skin, producing asbestos warts. However, asbestos fibres that penetrate the skin do not appear to pass through the skin into the blood (ATSDR 2001).

Measurement of exposure

Exposure to asbestos cannot be measured by absorbed dose or other biological measurement (at least not until after death) – unlike, for example, lead exposure. The options available, therefore, may be ranked as:

- direct estimation by personal air sampling (in the breathing zone)
- indirect estimation by stationary air sampling of personal environments
- qualitative exposure categorisation on the basis of questionnaires, interviews, inspections, historical records and/or exposure simulations
- categorisation into ‘exposed’ and ‘unexposed’ populations.

For all measures of exposures there are ethical, practical, and cost limitations. Logistical issues, quality control, sampling methods, sensitivity and specificity all need to be considered, and expert laboratory advice is generally needed before exposure measurement is undertaken. Appendix 1 details the procedures and issues around asbestos sampling and analysis.

Risk characterisation

Underlying asbestos risk assessment, and hence its health impact, are assumptions that are difficult to make. Extrapolation from observations of asbestos workers to predict the cancer risk caused by exposure in non-occupational situations involves measuring exposure and establishing a formula for the relationship between exposure and risk. While there may be little difficulty in estimating the excess risk, provided that the excess is substantial and suitable comparison rates are available for the local population, measuring exposure and choosing an appropriate dose–response model are substantially more difficult.

Risk characterisation involves integrating the outcomes of the previous steps in the risk assessment: hazard identification, dose response assessment and exposure assessment. Achieving this integration requires making a number of assumptions in cases where empirical information is not available. These assumptions result in a number of uncertainties associated with the risk assessment, which need to be acknowledged and discussed.

For example, there are uncertainties associated with:

- identifying and characterising the hazards
- the mathematical models used to estimate the risks in the dose–response assessment
- extrapolating observations from animal studies or from occupational settings involving high exposures to the risk of adverse effects at the relatively lower exposures in the non-occupational environment
- exposure estimates both in the occupational and non-occupational settings.

In assessing the risks of asbestos in the non-occupational environment, it is necessary to consider a number of uncertainties, ranging from indirect estimates of exposure to the use of

mathematical equations derived by the application of mathematical models to observations in workers. The following are some of these uncertainties.

- Risk estimation for non-occupational exposure relies on extrapolation from much higher levels of exposure in industry.
- Assessment of risk at low concentrations of asbestos fibres can be only indirect.
- The concentrations of asbestos fibres to which people may be exposed are far below the levels at which adverse effects have been reported for workers in the past.
- Reported cases of mesothelioma from non-occupational exposure to asbestos have been associated with para-occupational, domestic and/or neighbourhood exposure near asbestos mines or asbestos-using industries.
- Estimates of risk (for mesothelioma) are in broad agreement that the risk attributable to ambient concentrations of, for example, 0.5 f/L (0.0005 f/mL) is in the order of an excess lifetime risk of 1 per 100,000 or less for 10 years' exposure in school, or some 20 years' exposure in adult life.
- For lung cancer there are data to support increased incidence related to cumulative dose at high and moderate levels, but there are no real grounds that a linear relationship for lung cancer can be extrapolated back to the dose in non-occupational settings.
- There may also have been a low incidence of lung cancer as a consequence of para-occupational exposure to asbestos but it has not been possible to demonstrate this epidemiologically (because of the high background incidence of this disease). **Alternatively, the inability to measure an effect of low levels of asbestos on lung cancer may be because this disease is not caused by low levels of exposure to asbestos.**

Chapter 3:

Risk Communication

Main points

- The general public perceives risk in social and psychological terms rather than in technical risk terms. Risk communication must understand and be sensitive to this perception and aim to inform, show responsiveness and be a two-way process.
- When communicating risks it is important to show commitment, be open, demonstrate your knowledge and be empathic.

The general public does not base their perception of risk on technical risk assessment alone. Public recognition of risks, in contrast to risk assessment based on probabilities prepared by experts, includes intuitive risk perception. The characteristics of such perception appear to be related to concepts of fairness, familiarity, future and present ‘catastrophic potential’, and outrage at involuntary exposure to hazards not of one’s own making.

Asbestos hazards at home, where people expect to be safe, are among the hazards that the public will judge based on more than a scientific risk assessment. Comparisons of the level of risk with common risks, such as road traffic crashes, will generally not convince a person who feels that they – or their child – is at risk. Involuntary exposures that could cause a dreadful disease at some unknown future time, in a way that is still not understood, and for which there is little hope of cure, are particularly alarming. The level of alarm is compounded for asbestos due to its legacy of a high incidence of disease in the occupational setting and allegations of mismanagement by regulators in the mid 20th century.

Effective risk communication is more likely to be achieved if:

- a careful and sensitive explanation is given to assist and improve the level of understanding of the risk
- the feelings of dread towards asbestos-related disease are recognised, and efforts are made to assist a person to come to terms with those feelings before decisions are made
- the response to hazards that may affect a large number of people (especially children) is made with urgency and at an appropriate level (Warner 1983).

Bear in mind that in general:

- younger adults and better educated individuals tend to have more technical, scientific and medical knowledge about hazards
- the most concern about risks tends to be expressed by women, particularly those with young children, and by older people
- people tend to simplify complex and uncertain information into ‘rules of thumb’ (which, in the case of asbestos, may relate to the perception of occupational risk)
- people attempt to impose patterns on patternless events
- people overestimate the frequency of rare events and underestimate the frequency of common events

- individuals taking voluntary risks tend to be overconfident and believe they are not subject to the same risk as other individuals
- individuals forced to take involuntary risks overestimate the risk, and are unwilling to agree to 'acceptable risk' criteria set out by national and international agencies
- people tend to use past life experiences to relate to new situations, affecting their perception of the new situations (Health and Welfare Canada 1990).

Risk communication needs to be a two-way process, as described in some detail in *A Guide to Health Impact Assessment* (Ministry of Health 1998). It needs to be done in such a way that people are well informed and guided in the actions they can take, while knowing that the experts are taking account of, and acting on, their concerns.

To be effective communicators of the risks associated with asbestos in the non-occupational environment, PHU staff need to build credibility and trust with the affected individual or communities. Thus in any interaction, they need to:

- show that they are professionals committed to helping the affected people
- be open and receptive to the concerns expressed by the affected people
- establish their credentials to advise on the effects of asbestos
- be empathic.

In many cases, difficulties in managing environmental issues or communicating risks arise because the regulator's expectations differ from those of the affected people. Thus it is important to establish early in the process what the issues are, who is affected and what can be done about it and by whom. That is, the scope of the issue needs to be defined tightly (refer to Ministry of Health 1998).

For example, home owners who have put themselves at risk from asbestos need to recognise that they own the problem and that they will need to deal with it even though they can get advice from agencies. If contractors have caused the problem, then the issue should be referred to Department of Labour. This referral, however, should be made in a way that cannot be interpreted as 'passing the buck'.

Chapter 4: Risk Management

Main points

- The risk from exposure to asbestos in the non-occupational setting is considered to be low because the concentrations of airborne asbestos fibres are low.
- Property owners should seek expert advice from recognised and certified contractors if work with asbestos-containing materials is required.
- PHU staff investigating complaints should assess the issue and proceed according to a graded response protocol, identifying and assigning responsibility for managing the issue to the appropriate agency.

Risk management

Priorities for managing risk should be based on the risk assessment, but should also consider public perception of risk. The range of risk reduction alternatives must be evaluated, including in relation to their social, economic and cultural implications.

This evaluation could be undertaken along two lines:

1. control of actions and events that can translate an asbestos hazard into an asbestos risk
2. the removal or near-permanent containment of the asbestos hazard.

Asbestos exposures in non-occupational settings may vary greatly. A protocol for the management of such exposures should aim to provide a response that is graded according to the likely harm (exposures are likely to be several orders of magnitude less than current permissible workplace exposures).

Summary of the *Graded Response Protocol*

Note: This guide is essentially an operational document for PHU staff to refer to when investigating complaints. The question ‘Is it a public health issue – that is, a non-workplace issue?’ needs to be spelt out first. If a member of the public is concerned, then that person has to make a decision on who is going to fix the problem, namely, remove the asbestos. Once the person makes this decision and engages a contractor then it becomes a workplace issue for the employer to manage, with Department of Labour enforcing the standards.

Step 1: Initial response and preliminary assessment

- 1.1 Gather and record information
- 1.2 Identify and assess the hazard
- 1.3 Decide whether to proceed to Step 2
- 1.4 Identify and inform the agency most appropriate to take any further action
- 1.5 If not proceeding to Step 2, provide support and precautionary advice

Step 2: Inspection and hazard evaluation

- 2.1 Co-ordinate action/enforcement with the regulatory agency as appropriate and seek to carry out joint inspections
- 2.2 Confirm initial information
- 2.3 Obtain and record additional information to enable an adequate hazard evaluation
- 2.4 Identify and characterise hazards
- 2.5 Decide whether to proceed to Step 3
- 2.6 Provide advice to manage hazards and potential exposure, and ensure action is taken

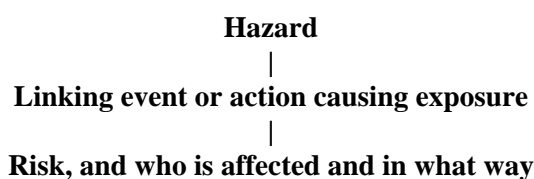
Step 3: Exposure measurement, risk estimation and assessment

- 3.1 Co-ordinate action/enforcement with the regulatory agency as appropriate and encourage joint inspection visits
- 3.2 Sample and analyse to determine presence and type of asbestos
- 3.3 Measure the concentration of respirable asbestos fibres in air
- 3.4 Estimate the exposure under normal conditions
- 3.5 Estimate the excess risk from the exposure and assess its significance
- 3.6 Communicate the risk
- 3.7 Recommend actions to manage risk and ensure action is taken

Background to the *Graded Response Protocol*

The guidelines and protocol aim to assist the PHU identify asbestos hazards and risks using a combination of interviews, observations and laboratory testing. Risk communication and recommendations for the management of hazards and risk may then proceed.

The mere presence of asbestos does not always create a risk. The risk of developing asbestos-related disease depends on exposure to airborne fibres of respirable size. A graded response is based on the following three elements.



More specifically, these elements are:

1. the nature and scale of the asbestos hazard and the corresponding potential to be a risk to human health
2. mechanisms that may open pathways of exposure to create risk
3. the nature of the risk in terms of probability, likely consequences, people affected and the degree of risk each may face. The existing state of health of each person will influence likely consequences for that individual.

Approaches to assessing hazards and risks

A graded response requires some way of assessing likely or actual human exposure to airborne asbestos. There are two complementary approaches.

1. Inspect, identify and assess deterioration of the material and the potential for fibre release (ie, a hazard)

This approach identifies the **hazard**. It should be used in every situation before exposure measurement.

A close inspection and assessment of the material alleged to contain asbestos will allow future action to be identified. If the condition of the material could result in the release of asbestos fibres into the air, then corrective action is justified. In making this assessment, the following questions should be answered.

- What type of asbestos-containing material is involved?
- Where is the material located?
- Is the material friable and likely to release fibres?
- Is there a potential for future disturbances, which may release fibres?
- Are individuals likely to be exposed to airborne fibres?

The nature and scale of the hazard should be estimated.

Settled surface dust sampling and analysis indicate the presence of asbestos contamination and the hazard, but cannot reliably indicate airborne dust concentrations.

At the end of the inspection and assessment process, a judgement may be made as to whether asbestos is being released and thus causing some unquantified exposure. It can be said that a risk has been established (ie, hazard + exposure) but the significance of the risk is still uncertain and unquantified.

2. Measure the actual or potential exposure (respirable fibres in air) from which health risk may be estimated

Measurement of exposure over time is important in quantifying **risk**. Exposure measurement by air sampling provides a measure of exposure over the time of sampling. It gives no indication of the potential levels of exposure at other times. This adds to the uncertainty of risk assessment and underscores the importance of inspection and assessment.

Measuring airborne fibres in a non-occupational environment is difficult due to the low levels of fibre likely to be found. An assessment of the level of risk will need to be made before sampling is undertaken. Sampling is warranted when there is a perceived risk or when the asbestos-containing material is friable and the risk of exposure is high.

Graded Response Protocol

How to use the *Graded Response Protocol* and *Report Sheets*

The *Report Sheets* at the end of the guidelines have spaces for information and decisions corresponding to the *Graded Response Protocol*. They repeat the information required but, once users are familiar with the guidelines, the *Report Sheets* may be used in the field without the whole document. The copies of *Report Sheets* on the disk provided with these guidelines may be 'customised' as users become familiar with them and decide to include or delete some of the information.

The principle is to grade the response to the level of hazard

In practice, Step 1 will always be completed. If the situation involves a place of work then the employer has duties to manage the risk, including through identifying hazards and ensuring a safe place of work. Steps 2 and 3 will only apply if a private home is involved – that is, not a place of work.

Step 1: Initial response and preliminary assessment

The aims of Step 1 are to:

- provide an initial response and support for the concerned person
- identify the agency most appropriate for further action
- identify the procedure to be followed for corrective action.

1.1 Gather and record information

Using the *Report Sheets* (Appendix 2), collect initial information from the informant by personal or telephone interview or possibly by a site visit.

Record informant details

- Contact person, their address and telephone number
- Nature of concern

Determine the location of potential asbestos hazard, type of building and building use

- Location (street address) of the suspected asbestos-containing material
- Type of building(s) (eg, dwelling, school, public building)
- Building use(s)
- Other type of location (eg, a landfill, building or demolition site).

Assess the nature, condition, quantity and accessibility of potential asbestos hazard

- Description of the suspected asbestos-containing material
- Information on the date that the suspected asbestos-containing material was installed (if known)
- Likelihood of being an asbestos-containing material (judging by the description and age)

- Likelihood of being a friable asbestos-containing material
- Whether it is inside or outside the home or building
- Level of accessibility of the suspected asbestos-containing material
- Potential for future damage, disturbance or erosion of the suspected asbestos-containing material
- Quantity of the suspected asbestos-containing material
- Condition of the suspected asbestos-containing material (eg, deteriorating asbestos-cement product, damaged insulation)
- Whether the hazard is airborne (eg, visible dust or other assessment).

Identify actions that may translate the hazard into a risk to health

- Who is taking, or is proposing to take, or has taken the action
- The nature of the action or disturbance affecting the suspected asbestos-containing material
- Whether it appears likely that asbestos will be (or has been) released by the action
- When the action or disturbance of asbestos-containing material is proposed, or when it happened
- Whether a change in building use is proposed that may require interior modification and disturbance of surfaces that may use asbestos-containing material
- Whether renovation or remodelling is proposed that may disturb asbestos-containing material.

Identify people at risk

- Who is at risk of exposure
- How the people at risk of exposure could be exposed
- The period over which the people may have been or will be at risk of exposure
- The state of health of the people or population at risk of exposure
- Who may be at greatest risk (eg, children, smokers).

1.2 Identify and assess the hazard

Identify and assess:

- the possible presence of a friable asbestos-containing material,* its condition and accessibility
- actions that may release asbestos fibres.

* Friable asbestos is defined in the HSE (Asbestos) Regulations 1998 as 'asbestos that under ordinary conditions can be easily crumbled'.

1.3 Decide whether to proceed to Step 2: Inspection and hazard evaluation

Take into consideration the need to:

- recommend action where it appears that work on asbestos-containing material may have released asbestos fibres already
- support the informant by explaining the nature of the hazard and its management.

1.4 Identify the most appropriate action to take

Consider whether the identified asbestos hazard requires the attention of Department of Labour, the territorial authority or (less likely) the regional council.

- Asbestos contamination within a private home may be the responsibility of the PHU.
- Asbestos contamination arising in workplaces, including through the actions of contractors at private homes, may require the attention of Department of Labour.
- Nuisances and/or conditions injurious to health should be acted on by the territorial authority.
- The discharge of asbestos as a contaminant involves the regional council.

Note: Under the HSE Act, the employer is responsible for managing the workplace and ensuring that it is safe for workers. This responsibility applies to all work activities and all places of work. This self-management approach does not require Department of Labour to be involved unless there is concern that safety is being compromised. The HSE Act does not apply to private homes unless a contractor is engaged to work in the home.

1.5 If not proceeding to Step 2, provide support and precautionary advice

Common sense actions to avoid unnecessary exposures or hazards are required to minimise risk.

- Provide copies of the most recent health education resource *All About Asbestos* (Code 7021) and, if appropriate, *Removing Asbestos from the Home* (Code 7022) published by the Ministry of Health (2007a and 2007b respectively).
- Emphasise the importance of seeking expert assistance if work with asbestos-containing materials is being considered.
- Confirm information given and remove all ambiguity. Make a site visit if you have not done so already. Be certain that information given is understood.

In all cases the capacity of the concerned person to understand the advice and take sensible action should be taken into account. Record the advice you have given in the *Report Sheets*.

Note: The goal is to reduce the potential for exposure to airborne asbestos due to the release of fibres. A principle, therefore, is that exposure should be reduced as a result of the action recommended.

Step 2: Inspection and hazard evaluation

The aims of Step 2 are to:

- identify and characterise hazard
- achieve actions to manage hazard.

2.1 Co-ordinate action/enforcement with the regulatory agency as appropriate and seek to carry out joint inspections

2.2 Confirm initial information

Visit the site and, using the *Report Sheets*, clarify, confirm or amend the initial information.

- Clarify the nature and underlying factors of the concern, as an understanding of the way the risk is perceived is essential in framing advice.
- Inspect conditions at the site.
- Complete a new *Report Sheet* only if absolutely necessary. (Keep the first copy as a record of the initial step.)

2.3 Obtain and record additional information to enable an adequate hazard evaluation

Collect information to enable a proper assessment and characterisation of the hazard. Records of buildings held by the owners or the local authority may give some indication of asbestos-containing materials used in the construction of the building (and what asbestos-containing material may have been removed), but should not be relied on.

- Identify any further **suspected asbestos-containing material**.
- Determine **composition**, type and approximate amount of asbestos present in the suspected asbestos-containing material from the information in Chapter 1 or by sampling and analysis (see Appendix 1). Complete the asbestos sample record sheet(s), which also provides a space for results.
- Examine the **condition** of the suspected asbestos-containing material for deterioration.
- Note the **accessibility** of the suspected asbestos-containing material (eg, potential for damage, vandalism).
- Assess the **quantity** of asbestos-containing material.
- Obtain a clear description of the **actions** that could disturb asbestos-containing material and lead to the release of fibres (eg, drilling and cutting, removal, reuse, renovation, repair or redecoration).
- Identify **people at risk of exposure**.
- **Document** the information in the *Report Sheets*.

2.4 Identify and characterise hazards

From the complete information obtained, including the results of sample analysis, identify each opportunity for the release of asbestos fibres (including the likely potential release from further damage) and characterise each hazard with information about the:

- type of material – friable/not friable

- type of asbestos – chrysotile/amphibole
- degree to which asbestos may be released – significant/not significant.

Also rank the significance of the hazard (high/low), assuming that there is an open pathway for exposure to vulnerable people.

Note that the presence of amphibole or mixed asbestos types is more hazardous than the presence of chrysotile alone.

At this point of the inspection and assessment process a judgement may be made as to whether asbestos is being released and so whether a risk has been established (ie, a hazard and a pathway of exposure to a receptor exist). However, the significance of the risk may be still uncertain and unquantified.

2.5 Decide whether to proceed to Step 3: Exposure measurement, risk estimation and assessment

A decision on whether to proceed to Step 3 will depend on:

- the significance of the hazard identified in Step 2.4
- the likely pathways for exposure
- the presence of vulnerable people
- the number of people who may be exposed
- cost versus benefit of undertaking Step 3
- the degree of importance of quantifying the risk, as opposed to identifying the hazard, and whether such risk assessment will lead to a better decision on priorities and action.

In particular, consider the need to:

- show adequate support and understanding for serious concerns
- assist understanding and reduce uncertainty and/or suspicion
- provide ‘hard’ evidence to support the need for action and/or enforcement
- add to an understanding of environmental conditions and so assist in future situations.

Note: Property owners or employers have responsibilities under the HSE Act if the site under consideration is a place of work. If a workplace is involved, they must make their own decisions about corrective action, in which they can be assisted by the information given above. A decision to proceed to Step 3 is not exclusive to providing advice as in Step 2.6 below. Advice should be offered at this stage regardless of whether exposure measurements and risk assessment will follow.

2.6 Provide advice to manage hazards and potential exposure, and ensure action is taken

Common sense actions to avoid unnecessary exposures or hazards are required to minimise risk.

- Provide copies of the most recent health education resource *All About Asbestos* (Code 7021) and, if appropriate, *Removing Asbestos from the Home* (Code 7022) (Ministry of Health 2007a and 2007b respectively).

- Emphasise the importance of seeking expert assistance if work with asbestos-containing materials is being considered.
- Confirm information given and remove all ambiguity. Make a site visit if you have not done so already. Be certain that information given is understood.

In all cases the capacity of the concerned person to understand the advice and take sensible action should be taken into account. Record the advice you have given in the *Report Sheets*.

Step 3: Exposure measurement, risk estimation and assessment

The aims of Step 3 are to:

- confirm the presence and type of asbestos in air
- estimate the exposure to respirable asbestos fibres
- communicate the risk
- recommend actions to manage risk.

3.1 Co-ordinate action/enforcement with the regulatory agency as appropriate and encourage joint inspection visits

3.2 Sample and analyse to determine presence and type of asbestos

Steps 1 and 2 cannot confirm the presence of asbestos fibres in the air, their type or their concentration. Sampling and qualitative analysis of suspected asbestos-containing materials will be relatively simple and quick as no quantification is sought. Air may be sampled or, following discussion with the laboratory, settled surface dust or bulk material may also be sampled.

Take into account the:

- person(s) and location(s) that are of interest
- factors considered in Appendix 1
- limitations of the information which will do little more than assist in the characterising of the hazards as considered in Step 2.4.

3.3 Measure the concentration of respirable asbestos fibres in air

Sampling and analysis of the air can indicate the number of fibres in air. This information can then be assessed for risk against recognised standards. Sampling should be undertaken only following consultation with the examining laboratory, using its methods and equipment. The laboratory will interpret the results. Department of Labour's *Guidelines for the Management and Disposal of Asbestos* (OSH 1995) discusses sampling in detail.

3.4 Estimate the exposure under normal conditions

Conditions chosen should represent the **normal** exposure conditions for the target person, **not** the most or least severe exposures.

Sampling should reflect the spaces most used so that an integrated exposure may be derived. A sufficient number of samples should be planned so that variations are reflected. The duration of sampling airflow through the filter membrane will be a factor in the sensitivity of the results and needs to be discussed with the laboratory.

When reliable results have been obtained, the concentration will be expressed in f/mL of air.

3.5 Estimate the risk from the exposure and assess its significance

The risks may be estimated in the following way.

- Compare the fibre concentration to which a person may have been exposed with the typical exposures and lifetime risk estimates.
- Compare the significance of the estimated risk against criteria of acceptable risk, taking into account the person at risk.
- Note that the risk assessment is more applicable to community risks than to individual risk. The estimate achieved by undertaking this risk assessment should then be categorised as 'high', 'moderate' or 'low' rather than provided to the exposed person as a number. A number may imply a degree of scientific accuracy that is not possible to achieve in risk assessment.
- Note that the acceptability of the risk to the individual exposed is for them to decide; the expert assists by providing information and improved understanding.

3.6 Communicate the risk

Risk estimates are **estimates** only, and may vary by several orders of magnitude. They are useful as a tool for putting the risk in context, making comparisons with risks estimated using similar methods and prioritising management options. The public perception and judgement of risk is based on many other factors, as discussed in Chapter 3.

Individual susceptibility, tobacco smoking, other exposures to asbestos, and exposures to other hazardous substances will impact on an individual's risk of adverse health effects from any given exposure to asbestos in the home.

Further guidance on risk communication is provided in:

- *A Guide to Health Impact Assessment* (Ministry of Health 1998)
- *Risk Assessment: A 'user friendly' guide* (PHC 1995)
- *Health Risk Determination: The challenge of health perception* (Health and Welfare Canada 1990).

3.7 Recommend actions to manage risk and ensure action is taken

Common sense actions to avoid unnecessary exposures or hazards are required to minimise risk. The assessment of risk (rather than hazard) may provide a sharper focus on what needs to be done.

- Provide copies of the most recent health education resource *All About Asbestos* (Code 7021) and, if appropriate, *Removing Asbestos from the Home* (Code 7022) published by the Ministry of Health (2007a and 2007b respectively).
- Emphasise the importance of seeking expert assistance if work with asbestos-containing materials is being considered.
- Confirm information given and remove all ambiguity. Make a site visit if you have not done so already. Be certain that information given is understood.

In all cases the capacity of the concerned person to understand the advice and take sensible action should be taken into account. Record the advice you have given in the *Report Sheets*.

Chapter 5: Roles and Responsibilities

Individuals and agencies with roles and responsibilities in preventing or managing asbestos hazards in non-occupational settings include:

- public health units
- territorial authorities (city and district councils)
- property owners, property managers and property occupiers.

Roles and responsibilities must be considered in three contexts:

1. the regulatory agency with statutory authority to bring about remedial action
2. the person or organisation responsible for taking remedial action
3. agencies with statutory functions to ensure that the facts are established and the best advice is made available.

Asbestos hazards need to be managed collaboratively to avoid duplicated effort, wasted resources and the perception of 'buck passing', and to ensure the most effective statutory response. Thus it is important to determine who has jurisdictional responsibility as a first step, then to ensure the issues are being addressed.

Role of the public health unit

The PHU may often be the first to be made aware of a concern about asbestos. Preliminary investigations (as set out in the *Protocol* following) should establish the responsible person(s) and any need to pass on this information to the others. Particular roles for the PHU include:

- providing specialist advice in epidemiology and toxicology where risk assessment is complex
- preparing statements or advice about the risks to individuals or groups
- providing scientific advice on whether sampling is likely to be useful
- undertaking measurement and identification of asbestos
- communicating risk to the public and the media
- providing advice to other agencies on how to communicate statements about risk to the public and the media effectively
- providing advice to lead agencies with statutory authority to effect remedies.

Role of the health protection officer

The skills of the health protection officer are necessary for the following activities.

1. **Initial response and preliminary assessment**
 - Receive, record and interpret queries and concerns.
 - Identify the cause of concern or complaint, the location and the associated parties.
 - Provide initial response and support to concerned people.

2. Inspection, hazard evaluation and risk assessment

- Identify person(s)/groups at risk.
- Identify compounding risks (eg, smoking, occupational exposure to asbestos).
- Identify sources of asbestos, asbestos hazards, and open pathways of exposure.
- Collect environmental samples for laboratory analysis.
- Interpret laboratory results.
- Seek advice from the Medical Officer of Health and others if necessary (eg, epidemiologists, toxicologists).
- Assess the likely health risk from the information collected.

3. Information and risk communication

- Explain how risk should be managed to the lead regulatory agency.
- Consult with building owners, building managers and occupiers as necessary.
- Refer information to the lead regulatory agency to bring about remedial action.

4. Management plans

- As a first step, determine who has jurisdiction, engage the lead regulatory agency and make sure that the issues are addressed.
- Assist the lead regulatory agency to determine appropriate action including, if necessary, the design of abatement and exposure control strategies.
- Maintain communication and co-operation with the regulatory agency and other parties (recognising privacy).
- Evaluate the effectiveness of the management plan.

In general, Department of Labour will take the lead in corrective action involving asbestos contamination if contractors are involved in the home. Most circumstances where the release of asbestos fibres would be an issue will involve public buildings or a workplace. Such circumstances will be the responsibility of Department of Labour. However, complaints about asbestos are likely to be received through the Ministry of Health and the PHU. Thus the PHU will have an important role in responding and co-ordinating subsequent action.

5. Enforcement

Here the primary role of the PHU is to support enforcement by the lead regulatory agency by providing information and advice.

The PHU may also consider health promotion initiatives aimed at increasing awareness of potential asbestos-containing materials and hazards associated with them. Health education resources are available to support such initiatives. A general information booklet, *All About Asbestos* (Code 7021) (Ministry of Health 2007a), has been prepared targeting the general public. Although obtaining expert assistance should always be recommended if work with

asbestos-containing materials is being considered, a further information booklet, *Removing Asbestos from the Home* (Code 7022) (Ministry of Health 2007b), is available if required.

Role of territorial authorities

In non-occupational settings, territorial authorities will normally be the lead regulatory agency with statutory authority to bring about a remedy. Territorial authority enforcement officers may collaborate with the other agencies, and the PHU should provide the territorial authority with information and advice. Since most issues to do with asbestos are likely to involve a workplace as defined under the HSE Act, territorial authorities should always co-ordinate action with Department of Labour to prevent duplication or confusion of roles.

Territorial authorities have duties and powers to prevent or control asbestos hazards under the following legislation.

Health Act 1956

The Health Act 1956 includes provision for territorial authorities to:

- improve, promote and protect the public health
- cause steps to be taken to abate nuisances or to remove conditions likely to be injurious to health or likely to be offensive
- enforce regulations under the Act
- make bylaws for the protection of public health
- issue cleansing orders or obtain closing orders.

Section 29 of the Act defines health ‘nuisances’ and generally includes matters ‘likely to be injurious to health’. Particularly relevant are references to:

- accumulations or deposits
- situation or state of premises
- conduct of any trade, business, manufacture or other undertaking.

Enforcement is determined by the District Court if a nuisance is not abated voluntarily except where immediate action is necessary. Works undertaken by a territorial authority to abate a nuisance may result in costs being recovered from the owner or occupier. It should be noted, however, that any person can lay information regarding a nuisance. A nuisance has to exist before any action can be taken and, accordingly, is not an effective means of preventive action.

Under section 41 of the Act, the territorial authority may serve a Cleansing Order on the owner or occupier, specifying the work to be carried out and the time in which to complete it. A Closing Order made under section 42 or 44 can be issued as a last resort to protect the occupants, but such action will not, of course, resolve any external release of asbestos.

Building Act 2004

The Building Act 2004 includes provision for territorial authorities to:

- require work to be done to prevent buildings from remaining or becoming dangerous or insanitary

- take measures to avert danger or rectify insanitary conditions
- issue project and land information memoranda revealing (*inter alia*) known hazardous contaminants.

A building consent will be required in most cases where demolition or structural alteration works are to occur. The ability to impose conditions on building consents appears to be limited to inspections or entering premises (section 222). Nevertheless, territorial authorities could, at their discretion, include a ‘Hazardous Building Material Warning’ on relevant consent documents.

Project Information Memoranda (PIMs) issued by territorial authorities must include information identifying special features of the land relating to the likely presence of hazardous contaminants where it is:

- relevant to the design and construction or alteration
- known to the territorial authority
- not apparent from the operative district plan.

Section 44A of the Local Government Official Information and Meetings Act 1987 allows for an application for a LIM (Land Information Memorandum). Section 44A(2) states that the LIM must include information concerning the ‘likely presence of hazardous substances’.

A PIM is required for a Demolition (Building) Consent. The PIM will advise if any restriction on demolition, for example a Heritage listing, exists in the city or district plan.

Sections 121 to 124 and 129 to 130 of the Building Act 2004 deal with dangerous or insanitary buildings. It is possible that the presence of asbestos could lead to a building being considered ‘dangerous’ or ‘insanitary’ for the purpose of the Act. ‘Insanitary’ buildings include those of such construction that they are likely to be injurious to health. In determining whether a building is insanitary, consideration must be given to:

- size of the building
- complexity of the building
- location of the building in relation to other buildings, public places and natural hazards
- intended use of the building, including any special traditional and cultural aspects of the intended use
- expected useful life of the building and any prolongation of that life
- reasonable practicality of any work concerned
- in the case of an existing building, any special historical or cultural value of that building
- any matter that the territorial authority considers to be relevant
- provisions of the building code.

Enforcement action is taken by way of formal notice requiring a remedy. An application for a Court Order authorising the council to do required work at the owner’s expense may be made on default.

An offence is committed if a building is used for a purpose for which it is not safe or sanitary.

Cases relating to sections 64 and 65 of the earlier Building Act 1991 may be useful references. These cases include *Hyslop v Dunedin City Council* (21.6.93) AP 35/93 (J Doogue, HC, Dunedin), which deals with asbestos on a building site, and *Marlborough District Council v Chaytor* (1995) DCR 382.

Resource Management Act 1991

In the Resource Management Act 1991:

- section 15 prohibits the discharge of contaminants into the environment except where some form of authority or consent exists
- section 17 requires every person to avoid, remedy or mitigate adverse effects on the environment.

Enforcement orders (Planning Tribunal) or abatement notices (enforcement officer) may be issued requiring a person to cease, or prohibiting a person from commencing, anything that is already or is likely to be:

- noxious
- dangerous
- offensive
- objectionable.

Similar action may require a person to take certain actions to avoid, remedy or mitigate adverse environmental effects.

The Resource Management Act 1991 also includes provision for territorial authorities to make plans and rules that deal with hazardous substances. The health protection officer should be aware of the appropriate provisions of plans, as advice given without such knowledge could create difficulties.

Local Government Act 1974

The Local Government Act 1974 includes the following provisions.

- Part XXXI provides for local authority refuse collection and disposal services.
- Disposal must be undertaken so as not to be a nuisance or injurious to health. Work generally must be to the satisfaction of the territorial authority but the Medical Officer of Health may also be interested.
- Bylaws may also be made prohibiting or regulating the deposit of refuse of any specified kind.

Demolition material containing asbestos will almost certainly arrive at council disposal sites. Service managers will need to determine strategies to deal with this issue to ensure environmental risk and council liability are minimised. Asbestos waste may only be disposed of at a place approved for the purposes by the territorial authority under the Resource Management Act 1991.

Role of property owners

Property owners and their agents should inform occupiers of the presence of asbestos-containing materials and must also act to remedy any asbestos hazards.

Statutory obligations

Property owners must:

- meet statutory obligations (eg, under the Health Act 1956, the Building Act 2004)
- obtain necessary building consents and any other necessary consents including those for the disposal of asbestos wastes.

Health and Safety in Employment (Asbestos) Regulations 1998

The Asbestos Regulations 1983 were replaced by the Health and Safety in Employment (Asbestos) Regulations in 1998. The new regulations brought in the concept of friable asbestos and linked that to the kind of work different people can do and cannot do. The regulations are directed primarily towards the control of asbestos in the workplace and place general duties on employers and employees for demolition of buildings containing asbestos; or encapsulation of materials containing friable asbestos; or the use of power saws or abrasive discs for asbestos-cement pipe cutting (without dust control). The amended regulations state 'that no person shall undertake restricted work unless he holds a Certificate of Competence'. The certificate is now issued by the Secretary of Labour.

A home owner is allowed to do restricted work with asbestos on their own home. If the home owner engages a contractor to do the work then the home becomes a workplace, the contractor must hold a certificate to do the work and jurisdictional responsibility transfers to Department of Labour.

The most common work undertaken by home owners is likely to be with asbestos-cement products (roofing and wall cladding) and decorative finishes. Provided that home owners do not try to encapsulate those products if they have become friable, or demolish (as opposed to repair) buildings containing asbestos, it appears that they would comply with the regulations. The restrictions regarding thermal or acoustic insulation and lagging would still apply, as would any work with power tools on asbestos-cement pipes.

Implementation of management plans

Responsible property owners will:

- administer and fund abatement work, environmental sampling and analysis
- engage certified contractors for abatement work
- monitor the performance of contractors
- ensure that routine maintenance work practices do not generate asbestos hazards
- monitor the condition of the property and abatement work to ensure that asbestos hazards do not recur
- inform contractors, occupiers and other building users of any asbestos hazards
- advise occupiers on how to manage risks

- inform purchasers of known or suspected asbestos hazards.

Examples of property owners documenting their roles are:

- *The Management of Asbestos in Schools: A guideline for property management staff* (Ministry of Education 1993)
- *Asbestos Policy and Code of Conduct* (Housing NZ 1994).

Role of property occupiers

Tenants should advise their landlord of the development of any asbestos hazard, minimise damage to asbestos-containing material, co-operate with the landlord in facilitating abatement work and act on advice from the health protection team regarding the avoidance of asbestos hazards.

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Appendix 1: Asbestos Sampling and Analysis

Main points

Air sampling

- Decide on the objective of sampling; generally the sample will be of ambient conditions in areas occupied by people at risk.
- Discuss the sampling objective and methodology with the laboratory.
- Schedule sampling to represent the normal cycle of activity in the area of interest.
- Keep full records of the sample and of the methods used in its examination.
- Agree measurement criteria with the laboratory, including size and types of fibres to be measured, and sensitivity required.
- Agree sampling protocol with the laboratory, including sampling rate and duration.
- If you need to compare the results with other or earlier samples, make sure you are comparing samples using similar protocols.

Sampling asbestos-containing material

- If in doubt that a material contains asbestos, have it examined by the laboratory.
- Follow the advice on how to take a sample.
- Be clear what you need to know from the laboratory examination.
- Do not expose yourself to asbestos fibres.

Safety when handling asbestos-containing material

These guidelines do not cover the safety of the PHU staff when handling asbestos-containing materials as this matter should be covered by their health and safety practices and they need to consult Department of Labour.

Introduction

The aims of sampling and analysis of asbestos-containing materials are to:

- identify asbestos and its types in an asbestos-containing material or in air
- measure the concentration of asbestos fibres in air.

Identifying asbestos fibres – involving either suspected asbestos in a material, or the presence of asbestos in a dust – requires sophisticated technology. The measurement of exposure to particles that are invisible to the naked eye and a hazard to health requires microscopic examination that identifies the size and types of asbestos fibres. The sampling strategies and methods of examination need to be selected for each particular circumstance, requiring close co-operation between the examining laboratory and the health protection team.

Air sampling

Air sampling strategies

Aspects of an air sampling strategy to consider are:

1. objectives of air sampling
2. sampler configuration and design
3. personal versus area sampling
4. scheduling of sample collection
5. statistical design
6. record keeping and quality assurance
7. air sampling and measurement of asbestos.

1. Objectives

Once the presence of asbestos fibres in air has been established, several different objectives can be addressed in evaluating exposures to airborne asbestos, including the following.

1. Measure personal exposures of individuals at particular risk, or of those who serve as sentinels for groups having similar exposures.
2. Measure ambient concentrations in areas occupied by people at potential risk. These concentrations should be measured during normal conditions of occupancy and activity. More elaborately, time-weighted average exposures could be calculated by combining time-activity patterns of individuals or groups and the asbestos concentrations in the areas in which they spend their time.
3. Make source-related measurements. These measurements can indicate the potential for human exposure and may range from the measurement of actual fibre release from asbestos-containing material (whether disturbed or not) to estimates of the potential fibre release under specific simulated circumstances.

2. Sampler configuration and design

The aim of configuration and design is to obtain a uniform deposition of a representative sample of airborne asbestos onto the filter surface. The laboratory should be informed of the exact situation and objectives and be asked to advise on appropriate steps.

An option is to use an aerodynamic size-selective inlet to prevent access to the filter of background particles and fibres that are too large to penetrate the upper respiratory tract. Inlets to accomplish this have been designed to meet the essentially equivalent criteria of 'International Standard, ISO 1983' (HEI 1991).

3. Personal versus area sampling

Building employees who disturb asbestos-containing material in the course of their work will be exposed to highly variable air concentrations of fibres. These are occupational situations (the responsibility of Department of Labour) requiring personal monitors drawing from the breathing zone. It is conceivable, however, that a home owner who insists on removing, or working on, asbestos-containing material in the home may require similar personal monitoring.

For building occupants not in contact with asbestos-containing material, samples collected from representative fixed locations should provide adequate estimates of personal exposure. Compared with personal sampling, area sampling is more practical and efficient and higher sampling air flow rates are possible.

The addition and removal of asbestos in air may be viewed in terms of **sources** and **sinks**. The primary source will be the asbestos-containing material that is releasing fibres; the secondary sources will be the re-suspension of fibres that have settled within the space. Sinks will be the removal and settling of fibres. The concentration of fibres measured will be the equilibrium concentration over the time of sampling. Activity and ventilation will therefore influence the concentration measured and should remain as close to the norm as possible.

4. Scheduling of sample collection

For general building occupants, air concentrations of asbestos fibres should be measured over relatively long time periods corresponding to occupancy cycles – that is, at least one full day or long enough to capture typical building activity patterns.

In buildings with air conditioning or ventilation systems, the pattern of exposure may vary with the seasons or even with individual days. Besides the indoor sampling, outdoor air samples should be collected near ventilation inlets to determine what the outdoor air may contribute to indoor fibre concentrations.

In the home, the variation of activity between weekdays and weekends should be reflected, as should changing activity patterns (particularly of children) due to the weather.

5. Statistical design

A statistical design should be discussed and agreed with the laboratory, taking into account:

1. the purpose of the study
2. the definition of the population under study
3. a statistical sampling strategy to obtain a representative sample of that population
4. the need for multiple (spatial) or repeated (temporal) sampling
5. sample size, for example to estimate the mean exposure to a specified degree of confidence
6. the expected temporal and spatial variability in measurements.

Because of the analytical limitations for a single sample analysis when evaluating the concentration of fibres, many of the samples are generally below the analytical sensitivity. An appropriate statistical strategy may need to be considered by the examining laboratory when interpreting such data (Rao et al 1991).

6. Record keeping and quality assurance

Proper interpretation of air sampling data depends on full consideration of all data relevant to the sample. In addition to the objectives above, information will be needed to verify whether concentrations exceed some acceptable value; show a trend; correlate with building activities,

maintenance or asbestos removal; or correlate with use of ventilation or air conditioning systems.

Accordingly, all sampling data should be related to factors that may influence the results or be of value in interpretation. Sample record sheets are provided in Appendix 2.

7. Air sampling and measurement of asbestos

Purpose of measurement

Measuring airborne asbestos evaluates the potential or extent of human exposure to airborne fibres. The measurement strategy needs to recognise the following (Johnson et al 1982).

1. Fibres within certain size ranges, if respired into the lung, can cause lung fibrosis, lung cancer and mesothelioma.
2. Health effects depend on where fibres are deposited (or migrate) and their physical–chemical properties. Important variables are length, width, composition, surface chemistry, and durability. (At high exposures, which are exceedingly unlikely in the context of these guidelines, consider the rate at which inhaled particles of all types accumulate, and whether this alters normal particle clearance rates. In such circumstances, additional sampling to detect peaks is required.)
3. Other particles and fibres coexist in air, often in much greater concentration than asbestos, so the appropriate method should be used.
4. Methods to identify and count asbestos fibres need to reflect the very different conditions presented by environmental concentrations, where concentrations are generally very low, compared with occupational situations.
5. The sensitivity of measurement methods needs to satisfy either: (a) typical ambient air concentrations; or (b) levels commensurate with lifetime risks of the order acceptable to the public.

There is a question about the measurement index best suited to assess the relatively low exposures and risks in the public environment (Bignon et al 1989). Bearing this in mind, the analysing laboratory's guidance should be sought on sampling methods and the analytical information required.

Sampling of suspected asbestos-containing materials

Objectives of sampling

The objective of sampling a suspected asbestos-containing material is to verify, or otherwise, the presence of asbestos and provide other information that will help in a risk assessment.

Identification of asbestos can only be achieved by scientific examination. Any suspect material should always be sent for examination as asbestos has been found to occur when not expected. Fibre type and the condition of the asbestos-containing material are also important to determine as they may influence the risk assessment.

How to sample asbestos-containing material

- Discuss the purpose and approach to sampling with the laboratory.
- Note that asbestos in some materials may not be uniformly distributed and composite samples may be needed. Laboratory advice should always be obtained **prior** to sampling.
- Ensure your safety, from both asbestos fibres and accident, while taking a sample. Friable material, easily damaged by sampling, may release significant numbers of fibres. Wear at least a half-face respirator.
- Wet the material to be sampled with water.
- Take a representative quantity of about 10 grams, say the size of a 10-cent coin or a teaspoonful, disturbing the sample as little as possible. (A core sample may be required for sprayed or trowelled insulation. Preferably use a single-use sampler that also acts as a container – such as an acrylic tube, about 12 mm wide and 100 mm long, bevelled to a cutting edge at one end fitted with caps.)
- Label with a unique number and place in a clean plastic bag; seal and protect from physical damage by packing.
- Clean debris with wet cloth and discard in a plastic bag; seal material with paint or core hole with a sealant.
- Complete relevant information in the sample record using a unique sample number.
- Send to the laboratory.

Information to be sought

The laboratory should provide information on the:

- presence of asbestos
- types of asbestos
- methods used in examination.

The laboratory may also be able to offer an opinion as to the approximate portions of asbestos in the sample if requested. If asbestos is 1 percent or greater by mass, consider material to be asbestos-containing material. This determination is likely to be necessary only if there is some doubt about the type of asbestos-containing material.

Appendix 2: Report Sheets

Copying and adapting the report sheets for your own use

Users may find it useful to copy parts of the text from the *Graded Response Protocol* and other material into the *Report Sheets*.

Step 1: Initial response and preliminary assessment

Reference number for this investigation:

Your name:

1.1 Gather and record information

Informant details

Date:

Contact person:

Address:

Phone:

Location of potential asbestos hazard, type of building and building use

The location (street address) of the suspected asbestos-containing material:

Person responsible at the site that is the subject of concern:

Address of this person:

Nature of concern:

Type of building – for example, dwelling:

Building use:

Other type of location – for example, a landfill, building or demolition site:

Spatial relationship to the site that is the subject of the concern – how far away, up-wind, overlooking, etc. Use description from concerned person at Step 1.

Provide sketch and add information at Step 2. Consider photograph or video recording.

Actions that may translate the potential hazard into a risk to health

Who is taking, proposing to take or has taken the action? This may be the home owner or a neighbour (residential or commercial), or it may be work being done or proposed in a public building or school.

Name (add description, eg, owner, neighbour):

Address:

What is the action or disturbance? Is it affecting the suspected asbestos-containing material? Add comment on scale, violence and duration.

Does it appear likely that asbestos will be (or has been) released by the actions?

Yes **No**

If 'Yes' proceed to Step 2 unless release can be managed by simple advice and person has good understanding of the hazard and precautions.

When is the action or disturbance of asbestos-containing material proposed, or when did it happen?

Date:

Time if relevant:

Is a change in building use proposed? Changes in use often require interior modification and disturbance of services and surfaces that may use asbestos-containing material. This would normally apply only to public or commercial buildings.

Yes **No**

If 'Yes' describe the change. Consider the need to proceed to Step 2 so that preventive action can be taken and make a note.

Is renovation or remodelling proposed? Alterations to the home of the concerned person, or of a neighbour, may require the disturbance/removal of asbestos-containing material.

Yes **No**

If 'Yes' describe the change. Consider the need to proceed to Step 2 so that preventive action can be taken and make a note.

Are there actions to do with an adjacent industry or business activity? There could be many other actions to asbestos-containing material, either in buildings or to do with processes or work. Note any other actions.

Yes **No**

People at risk

| |
|--|
| Who may be at greatest risk? Name(s): Relationship(s) to concerned person or other description: How could the people at risk be exposed? For example, where are children's bedrooms or play areas relative to the site of disturbance of probable asbestos-containing material? Over what period may the people have been, or will the people be at risk? Who is clearly not at significant risk of exposure? What is the state of health of the people or population at risk of exposure? |
|--|

1.2 Identify and assess the potential hazard

Report Table 1.2: Actions or potential for damage, disturbance or erosion

| Current condition of asbestos-containing material | Low | High |
|---|---|-------------------|
| Good | Unnecessary to proceed to Step 2 unless other factors are significant | Proceed to Step 2 |
| Minor damage or deterioration | Proceed to Step 2 unless simple advice can be safely given | Proceed to Step 2 |
| Poor | Proceed to Step 2 | Proceed to Step 2 |

1.3 Decide whether to proceed to Step 2: Inspection and hazard evaluation

Enter your decision and date here. Note the other factors referred to in the *Graded Response Protocol* for Step 1.3 before deciding.

| |
|--------------------|
| Decision: Date: |
|--------------------|

1.4 Identify and inform the agency most appropriate to take any further action

| | | |
|--|-----------|--------------|
| Does the asbestos hazard identified require the attention of Department of Labour, the territorial authority or (less likely) the regional council? | | |
| Yes | No | Maybe |
| Names of agencies: | | |
| Date approached: | | |
| Outcome: | | |
| Should the health protection team continue to be involved with the regulatory agency? | | |
| Yes | No | Maybe |
| Roles agreed for each: | | |
| What further inspections, assessments and action plans (which may follow a similar pattern to this Graded Response Protocol) would you recommend to any other authority? | | |

1.5 If not proceeding to Step 2, provide support and precautionary advice

Advice based on a preliminary assessment of the hazard should be simple: take nothing for granted, and be precautionary. Discourage do-it-yourself asbestos removal, and recommend that specialist firms are called in (Department of Labour has names and details).

Enter the advice given.

| |
|--|
| Date: |
| Advice given to: |
| Advice should be based on simple precautions, for example: |
| <ul style="list-style-type: none">• Do not attempt to do anything to, or handle, friable asbestos.• Avoid do-it-yourself asbestos removal. Call in specialist firms (Department of Labour has names and details). |
| Provide copy of Ministry of Health asbestos resource All About Asbestos (Code 7021) and, if appropriate, Removing Asbestos from the Home (Code 7022). |
| Other advice given (include information on other agencies to be involved): |
| Who else needs to be informed/involved (eg, landlord, property owners, other)?: |

Follow up on Step 1 if required

| |
|--|
| Date: |
| Result: |
| Follow-up, and/or action/enforcement by other agencies (including dates and action): |

In all cases the capacity of the concerned person to understand the advice and take sensible action should be taken into account.

Step 2: Inspection and hazard evaluation

2.1 Co-ordinate action/enforcement with the regulatory agency as appropriate

Record dates and nature of contact and consultation with Department of Labour, territorial authority or other (eg, regional council).

2.2 Confirm initial information

Visit the site and confirm or amend all the initial information by working through all the points in Step 1.1 above. Complete a new *Report Sheet* only if absolutely necessary. (Keep the first copy as a record of the initial step.)

2.3 Obtain and record additional information to enable an adequate hazard evaluation

Identify any further **suspect asbestos-containing material** (see Step 2.3 in the Graded Response Protocol for further information).

Examine the **condition** of the suspect asbestos-containing material for deterioration (seeking comment from the laboratory if the sample includes deteriorated material).

Note main findings in words here.

Sample for composition of the suspected asbestos-containing material. Test for friable asbestos-containing material (if not evident from a visual inspection) on site by rubbing and observe production of dust and particles; wear at least a half-face respirator. Complete sample record sheet (over) which also provides a space for results. Note: discuss with laboratory prior to sampling (refer Appendix 1).

2.3.1 Asbestos sample record

Sample unique number:
Reference number of investigation:
Reference of sample:
Relationship to other samples and their unique numbers:
Examining laboratory and contact name:
Where collected: address
When collected: date
Type of premises and use:
Owner:
Occupier:
Purpose of sample:
Type of sample: air, or asbestos-containing material (describe)
Location: description and sketch in plan and elevation of sampling position – use following sheet.
Site plan: show other potential sources of asbestos fibres (eg, adjoining structures, roads where vehicles brake) – use following sheet. Mark north point.
Sampler configuration and detail (eg, size selective inlet, membrane type, pore size (μm), area (cm^2))
Sampling duration: hours (from – to, using the 24-hour clock)
Air flow rate in l/minute:
Relevant activity at time of sample collection:
Describe ventilation in area sampled: natural (what) or mechanical or air conditioning.
Describe weather during sampling (especially for outdoor sample):

- wind direction
- approximate speed
- temperature
- precipitation
- comment (eg, fine, gusty, still)

2.3.2 Blank sheet for sketch of sample location and site plan

2.3.3 Results

Fibres per litre or presence of fibres in asbestos-containing material:
Type of fibres and proportions:
Method used in examination:
Sensitivity or detection limits:

Other results, comments or queries:
(Attach copy of laboratory report)

2.3.4 Sketch of building and location of asbestos-containing material

Make a sketch on the following sheet of locations, and note materials found and their condition. In the case of large buildings, try to obtain a copy of layout drawing from the territorial authority.

Note accessibility of the suspected asbestos-containing material on sketch on next page; assess as 'easy' or 'difficult' with children in mind. Note that accessibility is a measure of future damage, not exposure.

Assess the quantity of asbestos-containing material (see Step 2.2). Note areas of surfacing asbestos-containing material on sketch on next page and lengths of pipe or duct insulation in public areas.

2.3.5 Blank sheet for sketch of building and location of asbestos-containing material

2.3.6 Describe any disturbance of asbestos-containing material

Describe the **actions** proposed (or that have taken place) that could disturb asbestos-containing material and lead to the release of fibres. Write in words below and enter on sketch if helpful.

2.4 Identify and characterise hazards

From the complete information obtained, including the results of sample analysis, identify each opportunity for the release of asbestos fibres (including the likely potential release from further damage). It may be useful to mark the sketch with the main potential sources in colour. Describe below:

Report Table 2.4: Characterisation

| Where | Friable (F) or Not Friable (NF) | Asbestos type: C, A or M* | Releasability: Significant (S) or Not Significant (NS) | Hazard: High (H) or Low (L) |
|-------|---------------------------------|---------------------------|--|-----------------------------|
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* C = chrysotile; A = amphibole; M = mixed

Rank hazards as 'high' or 'low', assuming that there is an open pathway for exposure to vulnerable persons.

2.5 Decide whether to proceed to Step 3: Exposure measurement, risk estimation and assessment

| | |
|-----------------------------------|-----------|
| Enter decision: proceed to Step 3 | |
| Yes | No |
| Date: | |
| Reasons for decision: | |

2.6 Provide advice to manage hazards and potential exposure, and ensure action is taken

Report Table 2.6: Potential for future damage, disturbance or erosion and suggested action

| Current condition of asbestos-containing material | Low | High |
|---|--|--|
| Good | Take no further action now beyond operations and maintenance. | Undertake operations and maintenance measures to prevent damage. May require remediation to prevent further damage or deterioration. |
| Minor damage or deterioration | Operations and maintenance and local remediation are required. Prevent further damage. | Remediation is required as soon as possible to prevent further damage/deterioration. Operations and maintenance cleaning is required. |
| Poor | Remediation is required as soon as possible. Prevent access to minimise further damage. Operations and maintenance cleaning is required. | Remediation is required urgently. Evacuate people and isolate affected space from rest of building. Operations and maintenance cleaning is required. |

Discourage do-it-yourself asbestos removal and recommend that specialist firms are called in (Department of Labour has names and details).

Enter the advice given.

Date:

Advice given to:

Provide copy of the most recent Ministry of Health asbestos resource All About Asbestos (Code 7021) and, if appropriate, Removing Asbestos from the Home (Code 7022).

Other advice given (include information on other agencies to be involved):

Who else needs to be informed/involved? (eg, landlord, property owners, other)

Enter action/enforcement co-ordinated with other agencies from Step 2.1.

Note if asbestos waste generated and, if so, how, when and where waste was disposed of.

Follow up on Step 2

Date:

Result:

Follow-up, and/or action/enforcement by other agencies (including dates and action):

Step 3: Exposure measurement and risk assessment

3.1 Co-ordinate action/enforcement with the regulatory agency as appropriate

Record dates and nature of contact and consultation with Department of Labour, territorial authority or other (eg, regional council):

3.2 Sample and analyse to determine presence and type of asbestos

Discussed with laboratory:

Date:

With whom:

Decision:

Yes

No

If 'Yes' record method proposed.

Enter sample details and results on the sample record sheet(s) (see Step 2.3).

3.3 Measure the concentration of respirable asbestos fibres in air

| | | | |
|---|---|--------------------------|------------------------|
| Discussed with laboratory: | | | |
| Date: | | | |
| With whom: | | | |
| Decision: | | | |
| <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center;">Yes</td> <td style="width: 50%; text-align: center;">No</td> </tr> </table> | Yes | No | |
| Yes | No | | |
| If 'Yes' record ... | | | |
| Strategy: | | | |
| <table style="width: 100%; border: none;"> <tr> <td style="width: 33%; text-align: center;">Personal (special circumstances)</td> <td style="width: 33%; text-align: center;">Ambient (usually)</td> <td style="width: 33%; text-align: center;">Source (rarely)</td> </tr> </table> | Personal (special circumstances) | Ambient (usually) | Source (rarely) |
| Personal (special circumstances) | Ambient (usually) | Source (rarely) | |
| Why will the results be useful? | | | |
| Enter sample details and results on the sample record sheet(s) (see Step 2.3). | | | |

3.4 Estimate the exposure under normal conditions

(See *Graded Response Protocol* Steps 3.3 and 3.4 for note on adjustments)

Report Table 3.4: Exposure estimation

| Name of exposed | Age | Date(s) of exposure | f/mL | Adjusted exposure f/mL if appropriate |
|-----------------|-----|---------------------|------|---------------------------------------|
| | | | | |
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Note: Tables 5.1 and 5.2 make their own allowance for durations of exposure.

3.5 Estimate the risk

| | | | |
|---|-----------------|-----------------|-------------|
| Consider the estimation of excess risk in Step 3.5 of the Graded Response Protocol. <table style="width: 100%; border: none;"> <tr> <td style="width: 33%; text-align: center;">Low</td> <td style="width: 33%; text-align: center;">Moderate</td> <td style="width: 33%; text-align: center;">High</td> </tr> </table> | Low | Moderate | High |
| Low | Moderate | High | |

3.6 Communicate the risk

Consider the factors in risk communication in Chapter 1 (and in the other references) and summarise below the key points you will make:

To whom:

Date:

What further response is required?

3.7 Recommend actions to manage risk and ensure action is taken

Reconsider the advice entered at Step 2.6 in the Report Sheets, taking into account the risk estimates now available.

Recommend actions to manage risk:

Date:

To whom:

Provide a copy of the most recent Ministry of Health asbestos resource All About Asbestos (Code 7021) and, if appropriate, Removing Asbestos from the Home (Code 7022).

Other advice given (include information on other agencies to be involved):

Who else needs to be informed/involved (eg, landlord, property owners, other)?

Note if asbestos waste generated and, if so, how, when and where waste was disposed of.

Follow up on Step 3

Visit to confirm advice:

Date:

Comments:

Enter action/enforcement co-ordinated with other agencies from Step 3.1.

Glossary

| | |
|------------------------------|---|
| ATSDR | Agency for Toxic Substance and Disease Registry (USA) |
| µm | Micron (ie, one millionth of a metre – ie, 10 ⁻⁶ metres) |
| abatement | The removal or significant reduction of a source of hazard, and intervention to reduce exposure to a hazard |
| certified contractors | Contractors certified under the Asbestos Regulations to supervise and/or undertake ‘restricted work’ |
| CPSC | Consumer Product Safety Commission (USA) |
| DHB | District health board |
| DoL | Department of Labour |
| domestic | In or of the home environment |
| epidemiology | The study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems |
| exposure | A measure of a factor to which a population is exposed |
| f/L | Fibres per litre |
| f/mL | Fibres per millilitre |
| fibre.year/mL | The product of fibres per millilitre multiplied by years of exposure |
| friable asbestos | Defined in the Health and Safety In Employment Asbestos) Regulations 1998 in terms of releasability as ‘any material that contains asbestos that under ordinary conditions can easily be crumbled’. |
| hazard | A source or situation of potential harm |
| HEI | Health Effects Institute (USA) |
| HSE | Health and Safety in Employment Act 1992 |
| IARC | International Agency for Research on Cancer |
| incidence | The number of new cases or deaths that occur in a given period in a specified population |
| IPCS | International Programme on Chemical Safety |
| ISO | International Standards Organisation |
| L | litre, sometimes also written as <i>l</i> |
| LIM | Land Information Memorandum |
| mean | The sum of all the values in a set of data divided by the number of values |

| | |
|-----------------------------------|---|
| median | The central value in a set of data |
| MF/L | Million fibres per litre of water |
| NAS | National Academy of Sciences |
| neighbourhood | Vicinity |
| NIOSH | National Institute of Occupational Safety and Health |
| NZPHD | New Zealand Public Health and Disability Act 2000 |
| OSH | Occupational Safety and Health Service of the Department of Labour now called the Department of Labour (Workplace Services) |
| para-occupational exposure | Indirect exposure to a hazardous substance brought from the workplace to another place |
| PCM | Phase contrast microscopy |
| PHC | Public Health Commission |
| PHU | Public health unit |
| PIM | Project Information Memorandum |
| public building | Any building that the public may enter |
| remediation | All measures to remedy the potential harm from a hazard, including abatement and operation and maintenance |
| restricted work | <p>Work involving asbestos used as:</p> <ul style="list-style-type: none"> • thermal or acoustic insulation or linings, or fireproofing, in buildings, vehicles or ships • lagging around boilers, ducts, pipes or furnaces <p>The demolition of buildings, or parts of buildings or things containing asbestos</p> <p>The use of power saws (with any type of cutting blade or abrasive disc) on asbestos-cement pipe, except when used with certified dust control equipment</p> <p>Any work specified as restricted work by the Director-General of Health or the Secretary of Labour by notice published in the Gazette</p> |
| risk | The probability of harmful consequences arising from a hazard together with a measure of the scale or severity of the harmful consequence. In qualitative terms the risk may be said to have a probability that is 'high', 'moderate' or 'low' or another chosen term. In quantitative terms, the probability can range from zero (no possible harm) to unity (certainty that harm will occur). The scale and severity of the harm may be characterised by the number of people affected and the sort of harm (eg, death or serious injury). |
| risk assessment | The systematic acquisition and evaluation of information that enables the probability, scale and severity of the risk to be described |

| | |
|------------------------|---|
| risk management | All actions of a management nature that are designed to minimise risk to levels acceptable to the person(s) exposed to the risk |
| RM Act | Resource Management Act 1991 |
| SEM | Scanning electron microscopy |
| TEM | Transmission electron microscopy |
| TSI | Thermal system insulation (eg, lagging around boilers, pipes and ducts) to improve (hot or cold) thermal insulation |
| US EPA | United States Environmental Protection Agency |
| WES | Workplace Exposure Standards |
| WHO | World Health Organization |